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## EDITORIAL ANNOUNCEMENTS

*THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.*

*CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.*

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Representatives of the Firemen's, Telegraphers' and Conductors' Brotherhoods have met at Philadelphia to see about getting the Pennsylvania Legislature to ameliorate the law under which an engineman of the Pennsylvania Railroad, John J. Fleischut, was last autumn convicted and imprisoned for manslaughter in causing a collision. If there is to be any statutory punishment whatever for causing deaths by collision it is difficult to see how the crime can be defined any more leniently or more precisely than it is now defined. Manslaughter is the mildest term that can be used. The same term must be used for a collision killing a hundred passengers and for one killing a single tramp, and the adjustment of the punishment to the magnitude of the offense must be left to the court. In this case the term of imprisonment was only two months, the judge (at Norristown, October 8), reducing the sentence on account of the candor and manliness of the engineman at the trial. Surely, the brotherhoods cannot think that there should be no statute whatever; for the members themselves are liable to be killed by the carelessness of men in charge of trains, and ought to be glad to support any possible means of making such men cautious. According to the reports the engineman in this case had been on duty 22 hours, and the appeal to the Legislature will be based, no doubt, on the plea that he was obliged to work that long time or lose his job. Even if this were so, the argument does not fit the conditions, for the fault of the engineman was not in going to sleep, but in deliberate disregard of the rule and of plain safeguards when he was awake. His train, a freight, lay on a side track, and the men all slept. This may or may not have been excusable. But on awaking, they assumed that four trains had passed (in the opposite direction) when only three had passed and the fourth was yet to come. An engineman in such a situation who has been asleep and has no one to tell him what trains have passed is bound to flag himself out, or to wait until he can be helped out by some passing train. If all his brakemen are too sleepy to be trusted to flag, waiting is the only recourse. This duty is so plain that it is no wonder that the judge, in passing sentence said: "No man has a right to work on a railroad unless in fine physical condition, and if he falls asleep, no matter from what cause, he should discontinue work, even though he should lose his position, rather than jeopardize human life by continuing on duty. * * * You have my sympathy. You had a hard run, and no doubt were overworked, and physical exhaustion from long hours caused you to fall asleep. But the law does not regard that as an excuse."

But the judge went farther, and said that "the higher officers of the company, the despatchers, the train runners or other higher officials who exact labor of that kind from the men, should receive punishment if brought into court, where such accidents happen through following orders." In this the judge was technically right; but practically his words will do no good and will encourage the demagogic "friends of labor." Officers do not "exact labor of that kind." The higher officers forbid it. Lower officers often encourage it, indirectly, no doubt, to the extent of leaving enginemen to judge for themselves whether they ought to lie off for rest, when they ought to be *compelled* to lie off; ought to be compelled to give the benefit of the doubt to the public, the company and their own peace of mind, instead of giving it to their pocketbooks. An officer thus lacking in discretion and in moral firmness ought to be enlightened and corrected, surely; but this cannot be effected by prosecutions for manslaughter. The barren results of the efforts of the lawyers and the courts for the past 25 years ought to be sufficient evidence of that. The feeling among enginemen (or other employees) that they cannot, when in doubt, take the safe course, without jeopardizing their jobs, is not curable by hard and fast rules, either of legislatures and courts or of railroad managers and rule books. The only sure way of getting rid of it is by having trainmasters of the highest grade. The ideal trainmaster not only knows how to get trains over the road and to clear up congested yards, but also has the conscience to carry out the spirit of the law in the interest of safety, and the courage to discipline the trainmen regardless of their avarice and their bad judgment. In carrying out reasonable rules for safety he compels enginemen to avoid excessive hours and to refrain from taking risks to save time; but in thus rigidly disciplining them he must of necessity be reasonable; and thereby he convinces reasonable enginemen that he may be trusted not to oppress them when they lose time and have to come into his office to explain the delay.

## NEW HAVEN QUARREL SETTLED.

A review of the quarrel between the engineers and firemen on the New Haven road was printed in the *Railroad Gazette* February 24. It was pointed out at that time that the question at issue was whether or not the firemen's committee should be empowered to take up appeals from discipline with the officers of the road where the engineer making the appeal was a member of the Brotherhood of Locomotive Firemen. The custom had been that cases of appeal should be handled by the firemen's committee when firemen who belonged to the brotherhood were involved and by the engineers' committee in the case of engineers; but the Brotherhood of Locomotive Firemen complained that their cases were not being properly taken care of by the engineers' committee, and they wished to act independently of that body. The railroad company objected to this extension of the firemen's influence into the field of the engineers; probably for the underlying reason that it had more confidence in its engineers' brotherhood than in its firemen's, and did not wish the latter to become too strong. A circular issued under date of March 20 contains a statement of the satisfactory and pacific settlement which has been made. The company broadened the provisions of Article 1 of the schedule made with locomotive engineers in 1904. The clause which formerly read:

> All engineers will be given a fair chance to defend themselves against charges in holding investigations. All engineers who are interested will be allowed to choose a disinterested engineer to represent or accompany them on boards of investigation, if they so desire, when an appeal is made after the first investigation.

has been amended so that it now reads:

> All engineers will be given a fair chance to

defend themselves against charges in holding investigations. Superintendents and master mechanics will be careful to get all the information possible and hold investigations as soon as practicable. Engineers who are suspended and afterwards found innocent at the time of the original investigation shall receive pay for the time lost. All engineers suspended will be notified of the cause and length of suspension in writing. All engineers interested will be allowed to choose one or two disinterested engineers in the employ of the company to accompany and speak for them before boards of investigation, if they so desire, when an appeal is made after the first investigation. It is further agreed that in event engineers elected as per Article 1 fail to adjust grievance the matter can then be taken up and disposed of in accordance with the practice now in vogue on system; the case to be disposed of under the supervision of the engineers selected.

It will be seen that the company has maintained its contention that the integrity of the organization must be preserved; that is to say, that a firemen's committee must not speak for engineers. The changes in Article 1, as printed above, have the effect of allowing an engineer who belongs to the firemen's brotherhood and who lacks confidence in the engineers' brotherhood to proceed under what might be called the common law, without regard to the special statute which provides for representation by brotherhood committee. In accordance with this new modification of the company's "common law" the aggrieved engineer can at least select two friends to speak for him, provided they are in the regular employ. The company further points out in its circular that this settlement has greatly improved the service on the locomotives, which had become quite poor because of the long-drawn-out friction between the two men in the cab. However trivial the case may have looked on its face, it appeared for some time as if a strike was imminent, and the company is to be very much congratulated on having maintained its position while at the same time it kept negotiations on peaceful lines.

## PROPOSED EXTENSION OF PIG IRON WARRANT SYSTEM.

The American Pig Iron Storage Warrant Company has issued a circular to railroad presidents and traffic managers complaining that for 80 years the industries of the country have suffered acutely from the effects of having no reserve supply of pig iron, the basic material upon which all industrial progress is dependent. A comparison is made with the storing of grain at the time of harvest to last until the next harvest and with the reservoir system by which a community stores water in time of abundance to last throughout prospective droughts. It is pointed out that in 1890 this country was producing about 9,000,000 tons of iron, and that in 1897 it produced about the same amount, but in the interim the production dropped for four years to a six, seven and eight million ton rate, an aggregated reduction of 6,000,000 tons. The capacity to produce existed all the time, but was allowed to stand idle because there was no present need and no adequate means of carrying the stock until it was needed. It is held obvious that this idle furnace capacity of 6,000,000 tons of pig iron presented a loss not only to the furnace companies in their gross business, but also to the railroads in freight, and that unless a market can be created to absorb the surplus iron in times of reduced consumption in the future, the furnace companies and the railroads will again suffer a loss every time there is a temporary lull in consumption. It is probable that these 6,000,000 tons of reserve stock would not have reduced the production of iron during the active period by a singe ton, and that the country would have consumed the current product, as well as the surplus, even if the surplus had been twice or three times as great. It was not so much the lack of labor as the lack of iron which held back the construction enterprises of the country and delayed contracts seriously. When the active period came every industry in the country which used iron or any of its products had to wait for the blast furnaces to turn out pig iron, and for three years the clamor for iron on the part of consumers was so great that it was hardly allowed to get cold before it was placed on cars and forwarded to some one sorely in need of it, while the struggle to get it was so intense that the price went up two and three hundred per cent. The total stock in the yards of the merchant furnaces did not amount to one-half of one per cent. of the production. If a stock of 15,000,000 tons had been on hand at the close of 1897 it would all have been consumed during these three years, together with all that it was possible to make. It is pointed out that eight times in the last 80 years a large proportion of the iron furnaces of the country have lain idle for years, at a time when it was virtually a certainty that during the next season of revival the whole business of the country would suffer from the lack of a sufficient iron supply. It takes a year and a half to build a furnace, so that this serves in a way as a measure of the retardation at the start of each season of prosperity. In Scotland this state of affairs was corrected 60 years ago, and through the pig iron warrant system of that country, supplemented by exchange dealings, there has been carried a reserve stock equal to more than six months' production of iron, while in this country the average has only been about three weeks' product.

The Warrant Company makes the following proposition: that the railroads in the territory between the iron producing and iron consuming centers co-operate with the Warrant Company to make it practicable for the entire furnace capacity of the country to continue doing work during the seasons of dull consumption. This requires that the railroads carry a large surplus stock of iron in the dull periods, on which it is proposed to pay freight at current rates and at the time the service is performed. It is asked of the railroads that they lease to the Warrant Company, at a nominal rental, tracks of unoccupied land which they may have near large consuming centers. The Warrant Company and the exchanges through the medium of pig iron warrants and certificates proposes to handle this stock in the same manner that cotton, coffee, grain, etc., are carried through the instrumentality of exchange dealings. The advance in the price of iron is much greater than in any of the other staples. It costs less to carry than coffee, cotton or grain, and it requires no insurance—it cannot be destroyed by fire or flood. It is also asked of the railroads that they weigh, unload and reload the iron, without charge, on the land leased to the Warrant Company, as provided above. The reason for this stipulation is that no other interest could find any immediate benefit in undertaking this part of the work.

From a railroad standpoint, the advantage of the proposition to extend the pig iron warrant system lies in the tonnage to be furnished at a time of slack business, instead of at a time of congestion. It would undoubtedly have been a great benefit to the Pennsylvania, for example, to have had its iron tonnage distributed throughout 1901 and 1902, instead of piled on during the fall months of the latter year. A certain amount of this pig iron storage has been done for some years, as in the case of the Lehigh Valley and Central Railroad of New Jersey, with apparently good effects to the extent to which the experiment was carried, but it has been tried heretofore on too small a scale to accomplish much. The plan to keep on hand a surplus stock of from three to six months' production has much to recommend it. The exact arrangement to be made by the railroads for storage, handling, weighing, etc., is a matter which can presumably be adjusted by experiment. In Scotland, this service is charged for, but the charge is a very low one.

## CHICAGO ELEVATED ROADS.

The report of Mr. Bion J. Arnold to a committee of the City Council of Chicago on proposed plans for increasing the capacity of the Chicago Elevated Union Loop, part of which is printed in another column, contains some interesting data on the operation of one of the busiest railroads in the world. In many respects, the Chicago system of elevated railroads is by no means modern, yet on the Union Loop, under present conditions, it is possible to operate 1,600 trains a day on and off from the four trunk lines, on a headway of 19.5 seconds during the maximum rush period, morning and night. Trains make the two-mile circuit of the loop in 20 minutes during the busiest hours, including 11 station stops in that time. During the slack hours, trains go around the loop in from 13 to 15 minutes, making all stops. This is remarkably efficient operation, especially when the inadequate station platform facilities are taken into consideration, and the fact that trains of two of the roads using the loop have only one motor car with two or three trail cars, preventing rapid acceleration.

Mr. Arnold presents a number of schemes for increasing the capacity of the loop and recommends one in particular which, although much the most expensive, would increase the capacity nearly 100 per cent. The first recommendation with regard to this plan is to lengthen the platforms at all stations on the loop so as to permit two trains to load at the same time and pull out together, leaving the platform clear for two following trains to occupy it. In effect, this would reduce the space interval between trains by one-half, by practically combining two trains into one on entering and leaving a station. How this would work in actual practice is open to some question, because the efficiency of the plan would depend on the simultaneous action of the trainmen of both trains in making passengers "step lively," closing the gates and getting the trains under way at the same time. There would undoubtedly be some gain, but hardly

a saving of 25 per cent., as is claimed, and there is the added disadvantage of the confusion among the waiting passengers in reaching the proper end of the platform to take their train. It is, of course, essential that the platforms be lengthened, but a more rational plan would seem to be the adoption of the multiple unit control system on all of the lines and an increase in the length of each train to eight cars, reducing thereby the number of trains and the congestion at junction points. At present, three, four and five car trains are run, even during the rush hours, and the operation of each train as a unit is the cause of much of the delay and congestion. The only solution of the congestion in the New York subway seems to be in lengthening the platforms and increasing the number of cars in each train correspondingly, and it seems strange that no mention of such a scheme appears in Mr. Arnold's otherwise excellent analysis of the situation in Chicago.

The second recommendation of the report, in regard to increasing the stub-terminal facilities of all of the roads and taking care of traffic originating beyond the congested zone of the loop with trains arriving at and leaving from these terminals, is obviously a good one. The maximum capacity of each of the four trunk lines is not by any means reached under the present conditions, and as the manufacturing and business interests spread beyond the territory surrounded by the loop, there will be an increasing need of transportation facilities outside of the congested zone. The third recommendation, dealing with through routing around a portion of the loop, will be possible only in the event of the consolidation of all of the lines under one control and by making a number of changes in the connections at the junction points. An examination of the plans accompanying the report shows the desirability of adopting at least partial through routing from south and west to north, and the reverse, because of the relief afforded to half of the loop in each case, and the resultant increase in the number of trains that can be taken on and off the trunk lines. But the means for accomplishing this involve the expenditure of nearly half a million dollars and disfigurement of the streets by overhead crossings, with a double-deck elevated structure at the junction points. So high a structure would not only be a serious menace in case of fire, but would cut off what little light is left by the single-deck structure, and would be the cause of many damage suits. Without the overhead crossings, however, the interlocking movements for through routing would become so complicated and the delays so great that the time saved on the loop would be more than lost at the junctions.

The problem to be met is exceedingly complicated and difficult of satisfactory solution. Mr. Arnold has suggested a number of plans that would overcome at least some of the difficulties. But there is another way out of the difficulty, not mentioned in the report, which has the merit of being less expensive to carry out than the elevated crossing scheme with through routing, and which would relieve the congestion on the loop to an even greater degree. Like Mr. Arnold's plan, it would involve the partial through routing of trains by the consolidation of all of the roads, and in addition would require a new structure to be built on Quincy street between Fifth avenue and State street. The plan would be to utilize the south, east and north sides of the loop for through routing of all or nearly all trains on the Metropolitan and Oak Park lines, making the loop simply a continuance of each. The Northwestern and South Side trains could then be through routed down Fifth avenue, to Quincy street, through Quincy to State, and down State to the stub terminal of the South Side road at Congress street. This would require two crossings with the West Side trains, one at the present junction at Lake street and Fifth avenue and one at State and Van Buren street. These crossings could be overhead if necessary, and if made so, the entire interlocking system as at present used could be done away with. A modification even simpler would be to run the West Side trains up Fifth avenue and out on the main line, and through-route the South Side and Northwestern trains around the east and west sides of the present loop, thus doing entirely away with the elevated track on Van Buren street. By a suitable transfer station at Lake street and Fifth avenue, the accommodations offered would be almost as good as with the present system where trains of all four roads pass every station on the loop.

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American railroad managers who feel too poor to establish the block system on the most approved English plan—which we were taught in our youth to believe meant block sections never over a mile long—may derive some comfort from the statement, in a recent Board of Trade report, that the Midland Great Western of Ireland has some block sections 10 miles long. Ireland is not England, to be sure; and the block system was introduced on many of the Irish lines only after the law was passed which made the space interval compulsory; nevertheless, Ireland is a part of the Kingdom and any one who desires to follow the Board of Trade standards is entitled to look for them in Ireland if he wishes to do so. The existence of this block section of great length may possibly be the reason why the Midland Great Western figures in the present quarter's accident reports, for the collision which is the subject of the report appears to have been due to the impatience of an engineman—running a light inspection train, capable of high speed—at being compelled to wait at the entrance of the block section for a slow freight train to clear it. There were no serious personal injuries in the collision, but Lieut.-Colonel von Donop gives us the full particulars, nevertheless. The signalman at the entrance of the block section allowed the inspection train to come past his home signal and then gave the engineman oral instructions to proceed to the starting signal, which was at stop. But the engineman went right on; and he asserts that the starting signal was lowered for him. The signalman says it was not, and so the inspector has to decide which man tells the truth. A gate keeper near by corroborated the signalman, and the signalman at the outgoing end of the block section says that the special train had not been offered to him, so the inspector decides in favor of the signalman. As soon as the special had escaped him the signalman notified the other end that a train was "running away"; this was the first that the man at the other end knew of the train. The fireman on the special testified that as the train approached the signal he saw that it was at danger; but after that he took no further notice of it. The inspector does not express disapproval of this inattention, but he does hold the fireman partly responsible for the collision because on approaching the freight train he had a better view of it than the engineman, so that if he had been keeping a good lookout he could have prevented the collision. The smash-up occurred near the middle of the 10-mile section.

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### Cumberland Valley Railroad.

The Cumberland Valley Railroad, which runs from Harrisburg, Pa., southwest to Winchester, W. Va., 116 miles, with 47 miles of branches, is controlled by the Pennsylvania by ownership of 68 per cent. of its capital stock, but operated independently. Until 1902, the revenue of the company was derived almost entirely from the local business of the Cumberland valley. In that year, through the influence of the Pennsylvania, began a great increase in through traffic in bituminous coal received from the Baltimore & Ohio at Martinsburg, W. Va., and the Norfolk & Western at Hagerstown, Md. In 1901, the Cumberland Valley carried only 96,525 tons of bituminous coal. This increased to 295,802 tons in 1902, an increase of 199,277 tons; to 2,715,824 tons in 1903, an increase of 2,420,022 tons (nearly 1,000 per cent.), and in 1904, this one item of freight traffic amounted to 3,849,234 tons, an increase of 1,113,410 tons over the remarkably large increases of the two previous years. From these figures, it is evident that the Cumberland Valley has come to be part of a through route for West Virginia coal to Pennsylvania and the North.

The income account reflects this largely increased freight traffic. In 1902, gross earnings were $1,256,501; operating expenses, $896,174, and net earnings, $360,327. In 1903, gross earnings were $2,019,378, an increase of $762,878 over 1902; operating expenses were $1,600,955, an increase of $704,784, and net earnings were $418,423, an increase of $58,096. Evidently in that year expenses increased nearly as much as earnings. In 1904, however, gross earnings were $2,165,558, an increase of $146,180 over 1903; operating expenses $1,508,409, a decrease of $92,546, and net earnings $657,149, an increase of $283,726, while the operating ratio fell from 79.2 per cent. in 1903 to 69.6 per cent. in the year just closed. Passenger earnings have remained substantially at the same figure, so that the increase in earnings is almost entirely due to the freight business, which shows an increase of 22½ per cent. in the number of tons of freight hauled, and a decrease of 7.3 per cent. in the freight train mileage, proof of improved efficiency over the previous year. The total gross earnings per mile of road for 1904 are $13,323, an increase of $896 over 1903; operating expenses per mile of road decreased $567 in 1904, leaving an increase of $1,463 in net earnings per mile of road from $2,565 in 1903 to $4,028 in 1904.

On the general balance sheet, there has been no change in the item, "Cost of road, equipment and real estate," which is $2,510,733. The two increases in this item since 1901, one of $85,187 in 1902 and the other of $250,755 in 1903, represent purchases of real estate to accommodate increased traffic. During the past year, all of the first mortgage 8 per cent. bonds amounting to $139,500, have been paid in full, leaving a second mortgage of $94,000, maturing April 1, 1908, as the only existing bonded debt. Improvements costing $355,018, the principal items of which were five class H6a Pennsylvania standard consolidation freight locomotives, five standard wide-vestibule coaches, new sidings and second track and additional purchases of real estate, were met out of the income of the year, and $81,812 was carried forward to the extraordinary expenditure

fund. In addition to the items charged to the extraordinary expenditure fund, improvements amounting to $19,875 were charged to operating expenses. During the year, 1,974 tons of 100-lb. rails were used in replacements, new second track and revision of the line. Three miles of new second track were put in service, 2½ miles have since been completed and work is under way on 4½ miles which when completed will make a total of 24 miles of second track.

Traffic statistics show an increase of 6,585 tons in the tons carried per mile of road and an increase of 337,156 tons in tons carried one mile per mile of road. Freight earnings have increased $659 per mile of road over 1903, and freight expenses have decreased $537 per mile of road, giving an increase in net earnings from freight of $1,196 per mile of road. The average train load has increased from 214.74 tons in 1902 and 321.52 tons in 1903 to 513.52 tons in 1904, an increase over 1902 of 230.58 tons and over 1903 of 123.80 tons, another evidence of the increased efficiency of the freight equipment.

The report shows the increased value which may be created in a small railroad property by a large railroad corporation in control, which can so direct traffic from its affiliated lines that the small road may, in addition to its local traffic, come to be a profitable link in a large system.

## TRADE CATALOGUES.

*Machine Tools.*—By far the most interesting issue of the Progress Reporter yet published by the Niles-Bement-Pond Co., New York, is now being distributed. It contains 48 pages, most of which are devoted to full-page illustrations of the machines and works of the Schenectady branch of the American Locomotive Co. The machines shown have been designed for locomotive work, and are therefore of especial interest to all who are interested in railroad shops. Every master mechanic should be the possessor of a copy of this issue of the Progress Reporter.

*Ideal Power.*—The second number of this magazine under its new name, but No. 12 of Vol. I, contains as leading articles, "Changes Advised in Our Modern Fireproof Buildings," "Portable Pneumatic Drilling and Riveting Plant," "The Pleasure of Employees," "Canal Lock Doors in Paris," and "The Life of a Diver." Other articles include matters of interest pertaining to pneumatic and electric appliances.

*Acetylene Lighting.*—The Commercial Acetylene Company, New York, has reproduced in a small folder the newspaper accounts of a test recently made in Chicago before a committee of the City Council to prove that acetylene gas stored in tanks packed with asbestos saturated with acetone cannot be exploded by an electric spark introduced inside the tank. The test made at Chicago was conclusive enough to satisfy all of the witnesses.

*Wood Preservative.*—The C. A. Manufacturing Co., Austin, Texas, sends a small booklet describing the uses to which C. A. wood preserver has been put. This compound, also called Carbolineum America, is imported from Germany, and is intended to be applied simply by dipping or putting on with a brush, like paint.

*Concrete-Steel Bridges.*—The National Bridge Co., Indianapolis, Ind., has issued a handsome catalogue showing a number of recent bridges for highways and railroads built under its patents and describing in detail the method of calculating the proportions of spans designed for the special system of reinforcement used.

*Centrifugal Pumps.*—The De Laval Steam Turbine Company, Trenton, N. J., sends its catalogue B. Detailed descriptions and illustrations of the De Laval steam turbine and electro-motor centrifugal pumps are given. The principle advantages of this design of pump, as compared with the reciprocating pump, are also explained.

*Shop Improvements.*—Bulletin No. 175, issued by Dodge & Day, Philadelphia, Pa., illustrates and briefly describes the work of rebuilding and modernizing the plant of the Jeanesville Iron Works Co., Jeanesville, Pa.

## Increasing the Capacity of the Chicago Elevated Loop.

Mr. Bion J. Arnold has prepared an interesting report for the Committee on Local Transportation of the City Council of Chicago on the possibilities of increasing the capacity of the Union Elevated Loop and decreasing the noise caused by trains running on the elevated structure which has been the cause of much annoyance and numerous damage suits. The first part of the report deals with the suggested methods for increasing the capacity of the loop and discusses in detail the advantages and disadvantages of three different schemes.

The Union Elevated Loop, which encircles the business district of Chicago, is a two-tracked railroad two miles long, and it serves as a terminal for the traffic coming from practically seven different elevated railroad lines. The Metropolitan West Side Elevated brings in over the four-track structure east of Marshfield avenue the traffic from its four double-track branches. The traffic from the South Side Elevated road, as well as that from the Lake Street (name since changed to Chicago and Oak Park) and the Northwestern Elevated lines, is operated over this two-tracked structure simultaneously with the traffic coming from the Metropolitan lines.

No less than 1,600 trains ranging from two to five cars in length are delivered to the Loop Railroad daily. The total number of cars operated on the loop per day is 5,000. The traffic of the elevated railroads, like that of the surface lines which terminate in the business district, is principally handled during 90 minutes in the morning and 90 minutes in the evening. The period of maximum congestion on the loop tracks extends over approximately 30 minutes during the morning and 30 minutes during the evening rush hour. At these times the average headway between trains on the outer loop is 19.8 seconds and on the inner loop 19.5 seconds. The ultimate capacity of the loop tracks is fixed by the number of in-bound and out-bound trains which it is possible to pass through the junctions at Lake street and Fifth avenue, Wabash avenue and Van Buren street and Van Buren street and Fifth avenue.

It has been demonstrated that a train of five cars can be successfully and successively passed through one of the junctions from a state of rest to clearance, and the interlocking combinations be operated to open another route for the passage of incoming or outgoing trains in 45 seconds of time. If it were necessary to operate the interlocking mechanism for each in-bound and out-bound train, the capacity of these junctions would long ago have been exceeded. It is possible, and in fact is the usual practice, to simultaneously pass an in-bound and an out-bound train from the main line to the loop and vice versa. Under existing conditions, however, it is the station platforms on the loop and not the junctions which limit the number of trains that can be operated over its tracks.

These platforms are much too short to admit of trains being operated at intervals and speeds which will equal the capacity of the junctions. They should be lengthened sufficiently to permit two trains, of five or six cars each, to simultaneously occupy a platform. If the junctions were operated to their maximum capacity, the longest time to be consumed by a train in making one complete circuit of the loop should not exceed 15 minutes. Under the existing conditions, during the hours of maximum traffic, the average time consumed by a train in making a complete circuit of the loop is 20 minutes.

Should the time ever come when all the elevated railroads were consolidated under one control and passengers were transported within the district served by all of the companies for one fare, the problem of increasing the loop capacity would cease to be a problem, as the tracks now forming the loop, by slightly changing the present junction points, would become simply sections in through lines that would be operated between the North, South and West divisions. The loop could then be operated in conjunction with these through lines, as at present, to furnish terminal facilities for any auxiliary service that might be required during the morning and evening rush hours.

While universal through routing can be accomplished if demanded, the capacity of the loop would not, however, be increased to such an extent as seems necessary; but if through routing to as great a degree as is necessary, is acceptable, the capacity of the loop and of the roads operating over it can be greatly increased and the present method of operation simplified.

On the loop as it is now constructed and operated, the trains of the South Side Elevated and those of the Metropolitan West Side run upon the inner loop track, thus necessitating their crossing, both in-coming and out-going, at the outer loop track over which the Northwestern and Oak Park trains run; but these crossings are so designed that it is practicable for trains to pass on to and off from the inner loop simultaneously in case they chance to arrive at their respective loop connecting points at the same time. The point on the loop which now limits its capacity is where the Metropolitan tracks cross the outer loop track to enter and leave the inner loop at Fifth avenue and Van Buren street, where under present conditions of maximum operation 40 in-bound and 40 out-bound Metropolitan trains meet 67 Oak Park and Northwestern trains in one hour. The next most congested point is at Van Buren street and Wabash avenue, where 31 in-bound and 31 out-bound trains of the South Side Elevated meet 67 Oak Park and Northwestern trains in one hour.

Assuming that it is practicable to pass a train through these points and clear for another train in 45 seconds, the maximum number of trains that could enter the loop in one hour from either of these points would be 45, providing the interlocking plant had to be worked for each train; but since it is possible for a train to pass off from the loop at each of these points at the same time that a train is also passing on to it, the interlocking device needs to be worked but twice to allow the passage of three trains—one entering the loop, another leaving the loop, and the third crossing the tracks of the other two, and it is this feature that gives the present junction points their efficiency over any other that can be devised for the present method of loop operation, for it permits three trains to be handled through them in

one and a half minutes provided the trains chance to come, or are arranged to come, in such manner as to utilize this advantage.

It is this fact, in connection with the fact that under present conditions of operation the trains of the different roads become bunched in such a manner as to allow two or more of them to pass through a junction point with but one setting of the interlocking devices, that makes it possible to operate more than 45 trains on and 45 trains off the loop per hour at these points, and gives to the present loop system its high efficiency from an interlocking standpoint, which efficiency must be somewhat sacrificed with any method for through routing the trains between *all* the different sections of the city, although by providing for through service between the North and South Side systems and between the two West Side systems only, the congestion can be reduced, due to the through cars occupying but one-half the loop, and more cars can be operated over the loop per hour than at present. By elevating the structure at certain points the through routing features could be retained, the grade crossings eliminated, and the capacity of the loop would be increased 100 per cent. if only through cars were run.

At the present time there are in operation on the loop 49 trains during the maximum rush hours, the number being as follows:

| | |
|---|---|
| Metropolitan | 14 |
| South Side | 11 |
| Total No. trains, inner loop, at one time | 25 |
| Northwestern | 15 |
| Chicago & Oak Park | 9 |
| Total No. trains, outer loop at one time | 24 |
| Total No. trains operated, both loops | 49 |

The Metropolitan and South Side trains are allotted on the basis of five cars per train, and the Northwestern and Chicago & Oak Park are allotted on the basis of four cars per train.

The maximum train service in one hour, taken from a recent daily record, is as follows:

| | |
|---|---|
| Metropolitan | 40 |
| South Side | 31 |
| Northwestern | 42 |
| Chicago and Oak Park | 25 |
| Total No. trains passing over both tracks of loop in one hour | 138 |

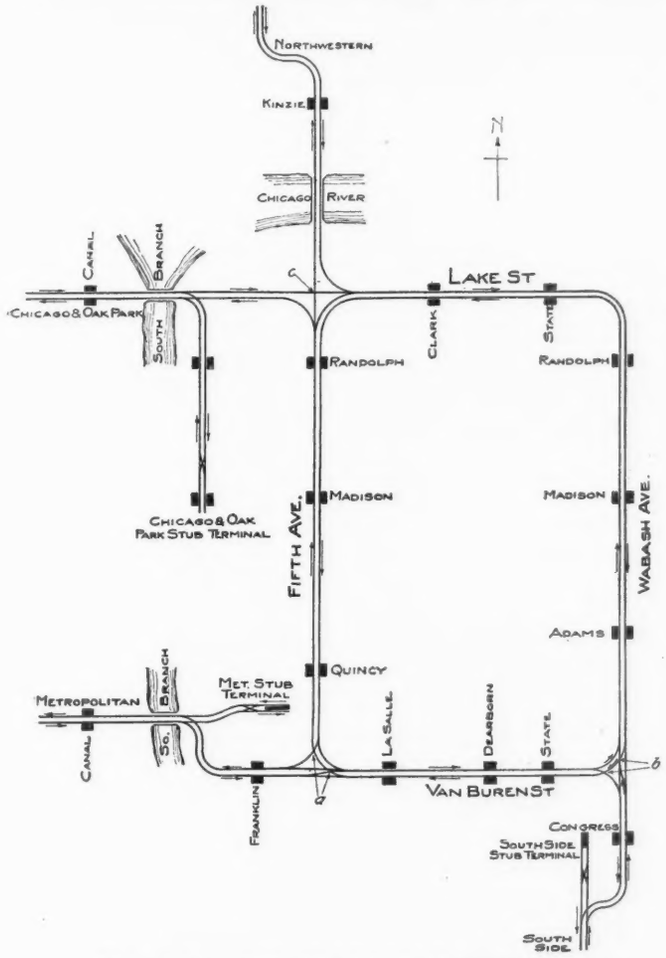
At the present time these trains are put around the loop during the rush hour period, when everything is working satisfactorily, under average conditions in from 18 to 20 minutes. During the middle of the day and at other than the rush hour periods, the running time around the loop is from 13 to 14 minutes, showing that when fewer trains are operated from the loop, the running time can be materially cut down owing to the loading facilities then being ample. But about 25 per cent. more trains could be put around the loop during the rush hour period under present conditions if additional platform facilities were provided.

A brief analysis of the several plans proposed may be of interest. The first involves the changing of the present structure and connections to permit the universal through routing of trains from any one of the three main divisions to any other division. This necessitates the use of both inside and outside tracks on the loop for the trains of any one road and would tend to confuse and bewilder passengers at stations and would also necessitate reversing the direction of operation of traffic on the Northwestern and Oak Park lines from left-hand running to right-hand running. The traffic would necessarily cross itself many times and for this reason the plan is not considered desirable.

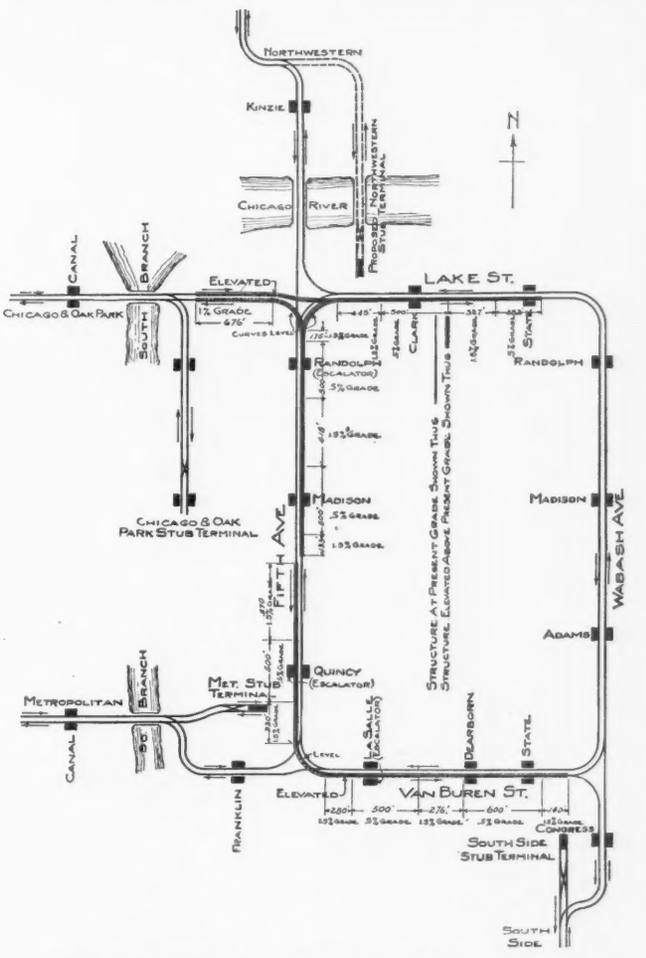
The second plan developed overcomes some of the objections to the first plan by applying partial through routing and loop trains as well for all lines. This plan has all of the advantages of the present system of operating loop trains and all of the chief advantages of through routing, and at the same time reduces the congestion on the loop.

The plan shown in Fig. 2 is believed to be, however, the best possible solution of the problem. It is based on the principle of partial through routing and operation of loop trains with the development of the stub-end terminal facilities of each of the roads as an important auxiliary aid to relieving the congestion at the stations on the loop. It is similar to the second proposed plan except that the crossings are eliminated by elevating the tracks of the inner loop over those of the outer loop at Fifth avenue and Lake street, and the outside track of the loop over the Metropolitan tracks at Fifth avenue and Van Buren street. The capacity of the systems would be limited only by the facilities for loading and unloading on the loop structure. Assuming that all trains operated were through trains, the capacity of the present loop and of the roads connected therewith would be increased 100 per cent., and by extending the platforms, thereby permitting increased facilities for loading and unloading, the capacity would be still further increased, and thus the advantages of the entire elevated and loop systems would be utilized to their maximum capacity.

If then, each road should be allowed a stub-




Plan of Present Elevated Loop and Connections.




Plan of Proposed Changes in Loop and Connections.

end terminal, its rush hour capacity could be still further increased, so that the only limit to the capacity of the elevated roads of the city would be determined by the number of main line tracks leading away from the terminals. Each road is now capable, so far as the main lines are concerned, of operating at least double its present number of trains, and it will thus be seen that if through routing and elevating should be adopted as suggested, the loop would then be capable of handling all the traffic the present double-tracked roads could deliver to it. Since, however, it will probably be advisable to continue operating a certain proportion of the trains of each road as loop trains, the capacity of the loop for through trains would be proportionately reduced; and as some of the roads now have three or four tracks, the surplus capacity of such roads over a double-tracked road would have to be taken care of outside the loop by stub-end terminals or auxiliary loops.

Should conditions make it practicable to extend the loop by removing the present Van Buren street structure to Polk street and building an additional structure to properly connect with it, thereby greatly extending what is known as the "Loop District" it could be accomplished without much difficulty. The terminals would then have a larger proportion of their cars in use on the loop owing to its increased size.

It should be noted that on the plan calling for the tracks of the loop to be elevated, the grades have been kept well within the limit for safe operation as the maximum grades are 1½ per cent. while in front of stations all grades have been reduced to one-half of 1 per cent. for a distance of 500 ft., thus giving ample room for two trains in case the platform should be extended. On the latter grade a train will stand without the brake being applied and this is the grade often used by railroads at stations.

The cost of changing the loop to conform to the above described systems would be about as follows:

| | |
|---|---|
| First plan, including necessary changes in special work; new interlocking power mechanism and the extension of platforms, but not including any alteration of present track or structure to reduce noise | $97,000 |
| Second plan, including necessary changes in special work; new interlocking power mechanism and the extension of platforms, but not including any alterations of present track or structure to reduce noise | 80,000 |
| Third plan shown in Fig. 2, including elevation of structure, removing and replacing track on elevated portions, modification of stations and platforms due to elevation; new power mechanism for interlocking plants, necessary changes in special work and the installation of escalators at Clark, Randolph, Quincy and La Salle streets, but not including any alterations of present track or structure to reduce noise. | 500,000 |

Summarized, the recommendations for increasing the capacity of the loop are as follows, arranged in the order of their merits in general and in sub-classification:

First.—a. Reconstruct, elevate and through route in accordance with plan shown in Fig. 2.

b. Extend the platforms.

c. Develop the stub-end or auxiliary terminals.

If it is found impracticable to elevate, then:

Second.—a. Reconstruct and through route in accordance with second proposed plan.

b. Extend the platforms.

c. Develop the stub-end or auxiliary terminals.

If on account of the diversified ownership of the roads, or for any other reason, it is found impracticable to secure through routing, then:

Third.—a. Leave the loop as it is now and install power mechanism for operating the switches and signals at the junctions.

b. Extend the platforms.

c. Develop the stub-end or auxiliary terminals.

## The Maintenance of Way Convention.

The American Railway Engineering and Maintenance of Way Association held its sixth annual meeting in the Auditorium Hotel, Chicago, March 21 to 23 inclusive. The attendance was the largest of any convention yet held, 165 members having registered. The membership of the association is now 463, a net increase over last year of 26. The balance on hand in the treasury is $3,654.

The officers for the ensuing year are: President, H. G. Kelley; First Vice-President, A. W. Johnston; Second Vice-President, James Dun (from 1904); Treasurer, W. S. Dawley (re-elected); Secretary, L. C. Fritch (re-elected); new Directors, J. B. Berry and W. McNab.

President Hunter McDonald in his address pronounced this the most important convention since the organization of the Association. After referring to various features affecting the welfare of the Association, he alluded to the practice of shunning all discussion of devices and appliances which are proprietary articles or covered by patents. As such devices are often indispensable articles of daily use the attitude of the association would seem to be incorrect. If the objects of the organization are to be attained there should be no hesitation in ferreting out and condemning the unworthy and commending the meritorious. He thought the association should not be so timid about recommending and adopting standards, since the word, after all, is only meant to stand for the best that it is known how to do; what it represents will and should change from year to year. Reference was made to the action of the special committee of the American Society of Civil Engineers on rail sections, which reported in favor of taking no action at present toward the modification of standard sections. This position was commended as correct; but though the sections were all right, the rails themselves were far from being so, and an exhaustive investigation to learn and fix the cause of the trouble was recommended. Another line of investigation which should be taken up is the design of a road adapted to the high speeds and wheel concentrations of the near future. The work of the special committee on classification of steam roads is progressing but the results will not be available for some time, and it is probable that the labors of the committee, which at present are confined to steam roads, may have to be extended to include electric roads; for although it cannot be foretold how rapidly the steam roads will adopt electricity, the problem is being studied with much earnestness, and the possibility of the roads being forced to such a course in self defense makes it appear that many of the members of the association will have to take up the study of electricity before their days of usefulness are over

### DISCUSSION OF REPORTS.

*Wooden Bridges and Trestles.*—Prof. Jacoby (Cornell Univ.) of the committee said he had found it extremely difficult to get information on trestles; probably because of their simplicity, engineers considered it unnecessary to make records such as are found of wooden bridges. For the latter there is a great deal of information, although certain lines of development appear to have been overlooked entirely in the records.

Consideration of the definitions brought out the usual discussion concerning various details of design and construction, and also of the verbiage, much time being consumed in this way. One such discussion related to "packing blocks." Mr. Berry (Union Pacific) contended that wooden packing blocks were antiquated; that iron only should be used. It was moved to strike out the definition allowing the definition following, of "packing spools or separators," to suffice. The motion was lost.

The definitions of "drift bolt" and "dowel" were also criticised, and after discussion were changed to read as follows:

*Drift Bolt.*—A round or square iron, with or without head or point, driven through one member of a structure and into another to connect them.

*Dowel.*—An iron or wood pin extending into but not through two members of a structure to connect them.

The specifications for bridge timber were next considered. The clause on bridge ties precipitated a discussion regarding the allowance of sap wood in such timber. Mr. Lum (Southern) advocated specifying clear heart material; sap wood is not considered in estimating the strength of the timber when it is new, and when the structure is old the sap wood is decayed and useless. It was pointed out that the clear heart timber would cost considerably more than when a certain percentage of sap wood was allowed. After a long discussion of this sort, the committee's specification, changed to allow sap only on two adjacent corners, was adopted.

In regard to what was meant by "close-grained," the committee was asked to state the number of annular rings per linear inch which would be admissible. The chairman stated that for yellow pine, which varied from 6 to 20, the committee thought 10 would be a safe minimum. It was pointed out that this could not be long-leaf pine, which runs from 30 to 43 rings per inch; it was therefore needless to specify "close-grained" for long-leaf pine. But Douglas fir varies greatly, and it was moved that the committee hereafter define what was meant by "close-grained" in reference to that timber, the motion being carried.

The remaining specifications, which include piling, were adopted with some slight changes in wording. The piling specifications applied only to square piles and a motion to ask the committee to add specifications for round piles of long-leaf yellow pine, following the same general requirements as for square piles of the same class, was adopted; also a motion by Mr. Loweth (C., M. & St. P.) to refer the specifications back to the committee for condensation.

Coming to the third conclusion in the report, which recommended the adoption of the plan submitted for a ballasted deck trestle, Mr. W. W. Curtis did not agree that the plan shown represented the best practice, believing a solid floor to be better. Some bridges built on the Southern Pacific 15 years ago, which had never needed attention by the bridge gang, were cited in support of his claim. The timber was, of course, creosoted and the plan was later abandoned by that and other roads because of the belief that creosoting the timber materially weakened its strength. This, however, Mr. Curtis denied. Mr. Montfort (L. & N.) said they had abandoned the solid floor for the type shown in the report because of the greater ease of inserting timbers for strengthening the latter when necessary. Mr. Robinson (Santa Fe) said the principal reason for the abandonment of the solid floor by the Southern Pacific was due to the kind of ballast used, which was gravel containing a large proportion of sand. The latter sifted through between the floor timbers,

making it necessary to surface the track about once a week.

The committee's third conclusion was referred back for further investigation, Mr. Montfort suggesting that in considering these two types of construction, the stiffness of the structure as well as the relative cost should be taken into account. Mr. Berry pointed out that as creosoting timber costs $17 to $20 a thousand feet, by omitting creosoted timber from certain parts of the structure some cost could be saved.

The committee withdrew its specifications for workmanship.

In regard to the recommendations for fiber stresses in long-leaf yellow pine and Douglas fir stringers, Mr. J. P. Snow (B. & M.), said that the fiber stress ought to vary with the ratio of depth to span; that a long shallow stringer, for instance, should have less fiber stress than recommended in the report (1,200 lbs.).

*Roadway.*—The specifications were taken up in detail, the chairman of the committee explaining such additions or changes as were made since the last report. Clause 19, on loose rock, caused some discussion, Mr. Churchill (N. & W.) having moved the omission of the words "steam shovel," and suggesting that the clause read: "Loose rock shall comprise all detached masses of rock or stone of more than 1 cu. ft. and less than 1 cu. yd. and all rock which can be properly removed by pick and bar, and without blasting, although steam shovel may be used or blasting may be resorted to on favorable occasions in order to facilitate the work."

This change was accepted by the committee. Clause 32 was changed by the committee from the reading in the report to the following form: "Subdrains of tile shall be constructed of the size and location as directed. Trenches for these drains must be taken out at least .. in. below cross line; the tile shall be laid on a bed which shall be true, with half-round section, with a filling of at least .. in. of cinders or other suitable material on either side and above the tile and then covered with ordinary soil to the top of the trench."

Under "Price and Measurement of Grading," clauses 48-A and 48-B on "haul" and "overhaul" were stricken out and the original clause on overhaul (1903 report) substituted.

Clause 60 dealt with the question of damages for delay to the train service by the contractor, recommending that there be a penalty for each minute of delay to each train. Mr. Berry (U. P.) cited a case where in double-tracking a busy piece of line (from Kansas City to Topeka) it was the desire to avoid all possible interference to traffic. There was universal opposition to the penalty clause by contractors because of the difficulty of determining fairly as to delays caused. They stated that if they were required to assume such responsibility, with such uncertainty regarding delays and with the frequency of trains, they would have to increase their prices. The difficulty was solved by putting, at the expense of the contractor, a flagman at each end of the piece of track and another at the steam shovel. These flagmen were subject to the control of the railroad company. Other members spoke of similar arrangements. Mr. Cushing (Pa. L. West) said their specification on this point was as follows: "The avoidance of detention to trains is a matter of the utmost importance, and the contractor will be held liable for any delays or damage to trains or damage to track caused by his acts or those of his employees. If there should be annoying and frequent detentions to the train service, the company reserves the right to cancel the contract on summary notice in writing to the contractor, and to complete the work at the expense of him and his bondsmen, as provided in the contract. Watchmen, both day and night, will be stationed by the company at all places where the engineer considers it necessary for the safety of the company's trains and work, and their cost shall be charged to the contractor and deducted from his estimate. It is to be distinctly understood, however, that they will be considered as employees of the contractor, and the contractor will be not relieved from liability and payment of damages caused by his operations or their neglect."

On motion the penalty portion of Clause 60 was stricken out.

Clause 65 related to crossings. Mr. Kelley (M. & St. L.) moved that an item be added, holding the contractor responsible for keeping the flange-ways open, and the planks kept properly spiked. Mr. Slifer, Chairman of the committee, thought the matter of keeping the planks spiked ought to remain in the hands of the railroad company. The question was finally settled by inserting the words "and maintaining" after "placing," which made the sentence read: "The material and labor of placing and maintaining the same will be furnished by the company and the actual cost charged to the contractor and deducted from his estimate."

The last sentence of Clause 81 reading, "The Chief Engineer shall be arbitrator, and his decision as to the intent and meaning of these specifications shall be final," occasioned some discussion. Mr. Kelley (M. & St. L.) spoke of an instance in his experience where there was an identical clause in a contract under suit and this clause was spoken of specifically by the judge, who said "this court will not delegate to any individual the right of adjudication." After some discussion the sentence was changed to read, "The decision of the Chief Engineer shall be final as to the intent and meaning of these specifications."

The conclusions were then taken up, the first reading, "There should be recognized three widths of roadbed and these should be selected to suit the possible density of traffic to be handled in the future. These widths should be 12, 16 and 20 ft." The plans showing these standard cross-sections were reproduced in these columns last week. Mr. Tye (Can. Pac.) moved to substitute 14 ft. for 12 ft. in the last sentence, saying that 12 ft. was too narrow, especially where there is rock. Mr. Slifer said this dimension was not intended for trunk lines, but there were a good many roads, such as lumber roads in the south, for which a 12-ft. width is sufficient. Mr. Kelley said that was only temporary construction, the standard in the south being 14 ft. Other members advocated the association recommending nothing less than 14 ft., and on vote Mr. Tye's motion was carried. Some other changes were made in the wording of the conclusion, the adopted form being: "There should be recognized three widths of roadbed for standard-gage railroad, and these should be selected to suit probable density of traffic to be handled in the future. These widths should be 14, 16 and 20 ft."

A discussion somewhat similar arose over the second conclusion recommending a width of 14 ft. between center lines of main tracks. Attention was called to the fact that in cities, where land is sold by the square foot, an additional foot on the width of line means a good deal of money. An amendment was offered reducing 14 ft. to 13 ft. Many roads are using 13 ft. and some 12 ft. Mr. Slifer said that on roads with the latter figure, on curves of 5 or 6 deg., trouble had been experienced when Pullman cars were widened several years ago, the markers being knocked off. Mr. Storey (Santa Fe) said if the association declared in favor of 13 ft. it might be used by attorneys to the detriment of the roads in damage suits. The lessened chance of a derailed car, which has not broken loose from its couplings, fouling the opposing track on a double-track line was also urged by a member in favor of greater width. After some further discussion the motion to change to 13 ft. was put and carried.

The third conclusion, requiring rock excavation to be taken out not less than 12 in. below sub-grade, was amended to 6 in. Mr. Kelley said 12 in., which made 24 in. below the ties, added greatly to the expense. There was little opposition urged to changing the figure and the motion to make it 6 in. prevailed.

The fourth conclusion, providing that no wasting be allowed closer than 10 ft. from slope stakes, was adopted.

*Rails.*—The committee asked for the experience of members regarding the breakage of rails. Attention was also directed to the specification that the test pieces should be taken from the top of the ingot.

Mr. Kenney (Pennsylvania) said that in almost every rail mill the drop test is made on a rail taken from the bottom of the ingot. They do not wish to test rails from the top, as the material is more or less segregated and will not give so good a test. He thought the roads should insist on the test rails coming from the top as it was not the best rails that were causing trouble but the worst ones; and if the test is made from the top, all of the rails are as good or better than that.

Mr. Fiero (R. W. Hunt & Co.) said he thought the mills tried hard to conform to the association's specifications, but his company's inspectors have trouble, and he expected they would continue to have.

The clause on "drop test" had the word "preferably" cut out, making it obligatory to take the test piece from the top of the ingot. A motion to reduce the heights of drop on the three heaviest weights of rail was lost.

The matter of finishing temperature and shrinkage in Clause 4 was then taken up. Mr. Webster (Chairman) said the latter clause is the same as used by the Pennsylvania, both east and west; that the Maryland Steel Company is rolling rails for the Pennsylvania according to this requirement, and that other mills should be able to do so. High finishing temperatures give a large grain, making brittle rails.

Mr. Carhart (Ill. Steel Co.) said a uniform shrinkage clause for all mills would work a hardship on some, as mills are differently constructed and only two in the country could conform to the committee's requirement in this respect.

Mr. Cushing (Pa. L. W.) said that since 1899 every year had brought a worse rail. He related an instance of where a piece 18 in. long had flown out of a rail laid one year, during the passage of a fast train.

Mr. Churchill (N. & W.) said that as a result of an investigation of many rail failures on his line, he visited some mills and found present practice all seems to be directed toward turning the rails out rapidly. Everything is paid for by the ton, labor is gaged by the ton, and there was every incentive for getting the rails out quickly, which might account for their overlooking cropping the ingot as much as should be done.

There was some further discussion along this line, and relation of experiences with broken and worn rails, and the matter was then closed without further action being taken.

*Iron and Steel Structures.*—The first important discussion on this report turned on

an amendment offered by Mr. W. R. Webster to Clause 165 under "Materials for Workmanship," relative to eye-bar tests. This read: "In eye-bar tests the ultimate strength, true elastic limit and the elongation in 10 ft., unless a different length is called for, shall be recorded," to which Mr. Webster added, "but in no case will eye-bars be accepted if the ultimate strength falls below 52,000 lbs. or the elastic limit below 26,000 lbs. per sq. in."

Mr. Cunningham (Wabash) amended to make the elastic limit not less than 50 per cent., and the ultimate strength not less than 55,000 lbs. Mr. C. H. Cartlidge (Burlington) said their specifications were in accordance with Mr. Cunningham's amendment and no difficulty had been found in having the requirements met. Mr. J. W. Schaub (Cons. Eng.) spoke of some large eye-bar tests of the Phoenix Bridge Company where the elastic limit did not fall below 30,000 lbs.

Mr. Snow (Chairman) pointed out that the material for eye-bars was provided for by the specimen tests under "penalty of material." That if the eye-bar is made properly from such material that it would be inconsistent to reject the bar if the latter failed to conform to the test requirements. It is piling on the difficulties to require another test after manufacture.

Mr. Webster said the committee was omitting what had been good practice for 15 years. That the material in the full-sized bar is not at all what it is in a carefully-annealed small bar. Mr. Webster's motion as amended by Mr. Cunningham was adopted.

Under "General Specifications for Steel Railroad Bridges," Clause 5 provided for 100 per cent. impact, distributed over three ties; fiber stress on ties not to exceed 2,000 lbs. per sq. in. Mr. A. F. Robinson (Santa Fe) objected to the fiber stress mentioned. The Santa Fe has locomotives with axle loads of from 50,000 to 62,000 lbs. He showed that with a 50,000-lb. axle load with 100 per cent. impact, on 8-in. x 8-in. ties sized to 7½ in. deep, the fiber stress would be 2,666 lbs., and sized 6½ in. deep, it would be 3,570 lbs. With a 56,000-lb. axle load the stresses would be 3,000 and 4,000 lbs. respectively. They are using 8-in. x 8-in. ties sized to 6½ in. deep, and where Douglas fir and long-leaf pine are used they have no trouble. If the committee's recommendation were adhered to it would require ties 12 in. to 18 in. deep, and he thought it unwise to limit the unit stresses to 2,000 lbs.

It was then moved to strike out that portion of the clause relating to fiber stress, but after further discussion the motion was lost.

Clause 10 related to impact. The committee recommended a formula to which some members took exception and a lengthy discussion ensued. In addition to its own formula, the committee had given in the report a number of other impact formulas, and Mr. Cunningham (Wabash) desired Pritchard's formula substituted for Schneider's (the committee's). The discussion ended by a motion to refer to the committee the whole question of live loads and unit stresses for further consideration. The motion was lost. A motion to substitute Pritchard's formula for Schneider's was likewise lost.

After briefly considering, seriatim, and revising somewhat the remaining clauses of the specifications, it was moved and carried that Part I be received as a progress report, referred back to the committee and the specifications as revised, and the discussion of the convention be printed in the Proceedings.

*Signaling and Interlocking.*—Beginning with this report the President announced that the consideration of the remaining reports would be limited to one hour each. The conclusions on interlocking plant signals were taken up first, in order, and adopted with little discussion and few changes. The fifth, which required that a distant signal should be provided for each home signal, had the last two words (home signal) changed to "route" to harmonize with the tenth.

Conclusion 9 provided that all mechanically operated high-speed signals be pipe connected. Mr. Kittredge (Big Four) asked if that applied to distant signals as well as home. Mr. Mock (Chairman) said both, the purpose being to discourage wire connections. However, for such signals, a preference was expressed for a power-operated signal, either gas, electric or pneumatic.

The second set of conclusions, concerning telegraph and controlled manual block signals, were then taken up, and the first four adopted with one or two slight changes. Consideration of the fifth and sixth, covering "specifications" and "definitions" respectively, was postponed.

*Yards and Terminals.*—Mr. Berg (Lehigh Valley) speaking for the committee having in charge the editing of the Manual of the association, specified what his committee would like considered in this report to enable certain matter in it to be included in the Manual. This included the definitions which were new or considerably changed. He moved to have them included in the Manual with a foot note to the effect that they had not yet been indorsed by the association. The conclusions were then taken up, only those that were new or revised, and which were suitably marked, being considered. One change was made, under "body tracks." The provision that, where they are parallel to the main track or other important running track, they should be spaced not less than 15 ft. c. to c. from said track, had this figure changed to 16 ft.

The conclusion on "rating car standing capacity of tracks" was adopted.

Mr. W. C. Cushing (Pa. L. W.) read a historical item regarding a hump yard on the Pennsylvania near Huff Station, built in 1881. It appears to have been the first artificial hump for classifying cars used on that road.

Mr. Churchill (N. & W.) suggested that in next year's report on hump yards, a number of cases of yards in successful operation with cars of 80,000 to 100,000 lbs. capacity, be included with drawings.

*Water Service.*—Mr. Kennicott (Ken. Wat. Soft. Co.), referring to the summary of Problem III of the report, said it would be a benefit to soften any water used in locomotive boilers containing 15 or more grains of hardening material per gallon, or even less if the material be sulphate of lime. But the number of grains of encrusting matter per gallon is only one factor in the consideration of whether or not a certain water should be treated. The quantity of water used should be considered. If at a certain station there were used 100,000 gals. of water a day containing 40 gr. per gal., the same amount of difficulty from foaming would be given by a station using 200,000 gals. per day with 20 gr. of encrusting materials. What interests the practical railroad man is the number of pounds of encrusting matter that enter the boiler at a given point within a given time. Where waters combine foaming and encrusting materials, it is sometimes best to remove the latter and put up with the former.

A desirable method for reporting water analyses for the examination of the railroad officer was also referred to. The use of "grains per gallon" has caused considerable confusion. He thought "pounds per thousand gallons" would be much more intelligible.

Mr. Raymer (P. & L. E.) spoke of the experience of his road, giving figures on the amount of water treated, number of plants, quality of water, etc., and of their entire satisfaction with the results obtained. During the last six months of 1904, which included a very dry spell, the average cost of water pumped, treated and delivered to storage tanks was 4¾ cents per thousand gallons.

Prof. Allen (Mass. Inst. Tech) referred to the effect of water purification on train load, the power of the locomotive at high speeds being dependent on its steam-producing capacity, which is, of course, diminished by incrustations in the boiler.

Prof. McGill (Can. Govt.) spoke of other chemicals besides lime and soda ash that can be used in softening water. He was in correspondence with makers of barium hydrate compounds in Germany and England, which promised to provide a substance that would reduce scaling solids without increasing the foaming qualities.

The summaries to Problems I, II and III were adopted with slight change, the most important being in Clause 3 of the last, in which the number of grains of solid matter in water which it would be a benefit to treat was changed from 15 to 7.

*Records, Reports and Accounts.*—The conclusions were adopted with one or two minor changes, the most important being the elimination in the 11th of the first two words in "Section Foremen's Monthly Material Report" and adding "track," making it read "Monthly Track Material Report."

*Buildings.*—The standard form of contract was not discussed. The conclusion relative to one general waiting room for local passenger stations was approved.

In the recommendations relative to the requirements of a modern roundhouse, the first was modified to read so that other forms of houses might be included, and the committee directed to make the other recommendations conform to this modification.

In No. 7, Mr. Rockwell (Lake Shore) did not think the association should go on record as recommending a rolling or a folding door. After some discussion the clause was amended by striking out the reference to the form of construction, simply requiring that the doors be made of fireproof material.

No. 9, on floors, recommending vitrified paving brick, was amended to provide simply that the floor should be of permanent construction.

No. 11 specified hot air heating by the indirect method. Mr. Rockwell said the latest houses of the Lake Shore were heated by steam; that they formerly used air and had given it up. The wording of the clause was altered to recommend the indirect method where hot air is used, the supply to be taken from the outside.

The remaining recommendations were adopted without change.

*Masonry.*—The part of this report considered related to the standard specification for Portland cement. The adoption of the joint specifications in lieu of previous specifications adopted by the association was moved and carried.

Conclusions 1 and 2 were received as a progress report and referred back to the committee for future presentation. The fifth was reworded to avoid ambiguity. The remainder were adopted as read.

*Ballasting.*—The specifications for stone ballast, gravel, cinders and burnt clay were adopted. The matter of cross-sections, constituting the remainder of the report, was referred back to the committee.

*Track.*—Mr. Berg moved the indorsement of the sections on maintenance of line and alinement, maintenance of surface, maintenance of gage, standard drilling, and frog blocking, in order to permit their inclusion in the Manual.

The only point discussed was the defini-

tion of "gage" which was amended to read: "The distance between the rails midway at a point 5/8 in. below the planes of the tops of the rails."

## Exhibits at the Maintenance of Way Association.

Numerically, the exhibits at the Engineering and Maintenance of Way Convention were somewhat less this year than last. In point of interest, however, they were fully up to the standard of previous years. They occupied the parlor floor of the Auditorium Hotel as usual, all available space being utilized. The list of exhibitors follows:

Adams & Westlake Co., Chicago.—Samples Adlake signal lanterns.

Amalgamated Gravity Battery Co., Philadelphia, Pa.—Full-sized samples of gravity battery plates.

American Asphaltum & Rubber Co., Chicago.—Samples of "Pioneer" mineral rubber bridge floor coating, also literature describing "Wasatch" structural paint.

American Ballast Co., Chicago.—Samples of burnt clay ballast.

American Equipment Co., St. Louis, Mo.—Full-sized samples and models of Miller anchor for wrecking and guying.

American Lock Washer Co., Chicago.—Samples of double positive lock washer.

American Standard Rail Joint Co., Bloomington, Ill.—Sample American standard insulated rail joint.

American Steel & Wire Co., Chicago.—Full-sized samples of steel wire fence.

American Valve & Meter Co., Cincinnati, Ohio.—Full-sized samples of "Economy" switch-stands and model of track and switch showing operation of switch-stands.

Armstrong Bros. Tool Co., Chicago.—Full-sized samples of Armstrong universal rachet and Armstrong claw bar with detachable claws.

S. A. Armstrong, Lindsay, Ont.—Samples of both wood and steel "Nogo" surface cattle guard with oscillating slats.

Atlas Railway Supply Co., Chicago.—Atlas rail joints, braces and tie plates, including the Atlas insulated and compromise joint.

Barker Mail Crane Co., Clinton, Iowa.—Full-sized Barker mail crane, device for putting up pouch. Blue-prints of mail catcher attached to bottom of mail car.

Beaver Dam Malleable Iron Co., Beaver Dam, Wis.—Samples of malleable-iron tie plates and rail braces; also F. & N. anti-spreader and anti-creeper.

Belle City Malleable Iron Co., Racine, Wis.—Samples of L. & S. anti-rail-creeper; also model of track showing effect of application of L. & S. anti-rail-creeper.

Bird & Son, F. W., East Walpole, Mass.—"Paroid" roofing, "Hydrex" waterproofing and Neponset insulating paper.

Border Bolt & Nut Lock Co., Richmond, Ind.—Samples of Border nut locks and bolts.

J. M. Brown, Chicago.—Samples of MacLeod's Buckeye lights and heaters and S. R. Slaymaker's switch locks and padlocks.

Brown-Sphinx Co., Chicago.—The Brown switch-stand.

Buda Foundry & Manufacturing Co., Chicago.—Paulus, Buda and Wilson track drills; switch-stands; rail benders; Buda car replacers; ratchet and friction jacks; track signs; eye, tie and connecting rods; pressed-steel switch clips; rail braces; compromise joints; Buda anti-friction metal.

Cambria Steel Co., Johnstown, Pa.—Sample 100 per cent. rail joint and 100 per cent. insulated rail joint.

Chicago Bridge & Iron Co., Chicago.—Photographs showing steel tanks and towers built for various railroads.

Chicago Steel Tape Co., Chicago.—Measuring tapes and jointed leveling rods.

Chicago Wire Fence & Tool Co., Chicago.—Heavy fence stays and tools.

Climax Stock Guard Co., Chicago.—Samples and model showing Climax shale clay stock guard.

Consolidated Cross Tie Co., New York.—Full-sized ties hewed with the Hege cross-tie hewing machine, also samples of ties treated with the Guissani process of wood preserving.

Cortwright Metal Roofing Co., Philadelphia, Pa.—Samples of metal roofing.

Coughlin-Sanford Switch Co., New York.—Working model of track showing Coughlin-Sanford swing rail frog.

Dayton Hydraulic Machine Co., Dayton, Ohio.—Showing the Brooks centrifugal pump in operation.

Paul Dickinson, Chicago.—Sectional models of roundhouse equipped with the Dickinson movable smoke-jack and Dickinson ventilator; also full-sized section of Dickinson smoke-jack made from "vitribestos."

Dilworth, Porter & Co., Pittsburg, Pa.—Samples of the Goldie "Perfect" railroad spike, Goldie claw tie plates and Glendon flange tie plates.

Jos. Dixon Crucible Co., Jersey City, N. J.—Samples of Dixon silica graphite paint, and of lumber crayons.

Doelp Forging & Casting Specialty Co., Lima, Ohio.—Samples of the Doelp perfection lock nut.

Dormant Sod Co., Chicago.—Specimens of dry fertilizer and grass seeds in sheet form ready for laying. Also miniature railroad station with yard sodded with Dormant sod.

Eyeless Tool Co., Newark, N. J.—Samples of eyeless picks, hammers, sledges, etc.

Eastern Granite Roofing Co., New York.—Samples of perfected Granite roofing and sand-surfaced roofing.

Edison Manufacturing Co., Orange, N. J.—Edison primary batteries for semaphore signals and crossing bells.

Fairbanks, Morse & Co., Chicago.—Full-sized Sheffield inspection car; also samples of Barrett track jacks, and model of water crane.

Chas. A. Gilchrist, New York.—Sample wedge rail joint; also rail and tie plates.

William Goldie, Jr., & Co., Bay City, Mich.—Samples of the Goldie perefect tie plug.

Grip Nut Co., Chicago.—"Grip" nuts in various sizes.

Hall Rail Joint Co., Chicago.—Samples of the Hall rail joint for various sized rails.

E. T. Harris, Chicago.—Full-sized "Red Cross" folding velocipede.

The Hart Steel Co., New York.—Samples of Hart tie plates.

Hussey Binns Shovel Co., Pittsburg, Pa.—Samples of shovels and scoops.

Independent Railroad Supply Co., Chicago.—Showing the Wolhaupter compromise rail joint and standard Wolhaupter rail joints for various sized rails.

Ingersoll-Sergeant Drill Co., New York.—Chipping and riveting hammers and hose couplings.

Illinois Malleable Iron Co., Chicago.—Model of the Bruyn smoke-jack.

Illinois Steel Co. (Cement Department), Chicago.—Photographs of concrete bridges built with Universal Portland cement; also samples of material showing method of manufacture of Universal Portland cement.

W. R. Jacques, Kansas City, Mo.—Model of track, showing K-K blocker and derailer.

The O. F. Jordan Co., Chicago.—Photographs and literature descriptive of the Jordan ballast spreader.

Keuffel & Esser Co., New York.—Sample steel tapes, transits, surveying and measuring instruments.

A. Leschen & Sons Rope Co., St. Louis, Mo.—Samples of Hercules wire rope in various sizes for switch rope, ballast rope, etc.; also blocks and tackles.

Lidgerwood Mfg. Co., New York.—Photographs of hoisting engines, Lidgerwood rapid unloader and apparatus for coaling vessels at sea.

Link Belt Machinery Co., Chicago.—Photographs showing coaling stations erected for various railroads.

Walter MacLeod & Co., Cincinnati, Ohio.—Sample Buckeye light and heater. Photographs of railroad labor saving devices.

Ludowici Roofing Tile Co., Chicago.—Samples of terra cotta roofing tile.

Mahoney Railroad Ditching Machine Co., Vincennes, Ind.—Working model of railroad ditching machine.

Mann-McCann Co., Chicago.—Model roundhouse, showing Ravelin system for electric wiring. Photographs of McCann ballast spreader.

McClintock Manufacturing Co., St. Paul, Minn.—Working model of track and locomotive showing application and operation of McClintock automatic block signal and locomotive telegraph and telephone system.

Merchant & Co., Philadelphia, Pa.—Full-sized sample "Star" cast iron ventilator for roundhouse.

Merrill, Stevens Co., Kalamazoo, Mich.—Track jacks and Cook's patent cattle guard.

Miller Anchor Co., Norwalk, Ohio.—Full-sized samples and nickel-plated models of Miller anchor for wrecking and guying purposes.

Morden Frog & Crossing Co., Chicago.—Model of track and switch, showing "Security" switch-stand; samples G. L. M. switch-stand.

Municipal Engineering & Contracting Co., Chicago.—Working model of Chicago improved cubical concrete mixer.

National Coal Dump Car Co., Chicago.—Photographs and literature illustrating the National coal dump car.

National Lock Washer Co., Newark, N. J.—Samples of various sizes of National lock washers.

National Roofing Co., Tonawanda, N. Y.—Samples of "Security" mineral asphalt roofing.

National Surface Guard Co., Chicago.—Full-sized samples of the National steel surface guard.

Geo. P. Nichols & Bro., Chicago.—Transparencies showing turntables, transfer tables and cranes installed on various roads.

Otto Gas Engine Co., Philadelphia and Chicago.—Photographs showing coaling stations, water tanks and cranes, sand blast and pneumatic tool car, sample Battelles dry chemical fire extinguisher.

The Pennsylvania Steel Co., Philadelphia, Pa.—Models of "New Century" switch with adjustable stand and double crank, Manard anvil face frog, plain and reinforced split switches.

Railroad Supply Co., Chicago.—Samples Wolhaupter, Q. & W. and Servis tie plates; also full-sized "Chicago" crossing signal in operation.

Railway Appliances Co., Chicago.—Samples Q. & C.-Bonzano rail joint; Q. & C. anti-rail-creeper.

Rand Drill Co., New York.—Photographs of Imperial air compressors and Rand drills.

Ramapo Iron Works, Niagara Falls, N. Y.—Model showing MacPherson's patent safety switch; also full-sized switch-stand equipped with scale to show power of stand.

Roberts Car & Wheel Co., Three Rivers, Mich.—Hand-car wheels and pressed steel hand-car frame.

Robertson Manufacturing Co., Chicago.—Photographs and drawings showing Rodger ballast cars and Hart convertible cars in service, also work performed.

Safety Nut Lock Co., Minneapolis, Minn.—Samples of the Safety nut lock.

Scherzer Rolling Lift Bridge Co., Chicago.—Album and miscellaneous photographs showing Scherzer rolling lift bridges.

Scott Manufacturing Co., Racine, Wis.—Samples of Racine rail anchor and pamphlet describing the Hercules bumping post.

R. Seelig, Chicago.—Engineers' Y level, with improved telescope.

S. R. Slaymaker, Lancaster, Pa.—Samples of switch-locks and padlocks.

St. Louis Expanded Metal Fireproofing Co., St. Louis, Mo.—Samples of various sizes of Johnson corrugated bars.

Spencer Otis Co., Chicago.—Samples of Hart tie plates and photographs of the National coal dump car.

Stowell Manufacturing & Foundry Co., South Milwaukee, Wis.—Showing the Wilbern door hanger.

J. B. Strauss, C. E., Chicago.—Working model of the Strauss trunnion bascule bridge; model of a ribbed reinforced concrete bridge.

Trussed Concrete Steel Co., Detroit, Mich.—Samples of Kahn trussed bar for reinforcing concrete.

United States Steel Piling Co., Chicago.—Models and blue-prints showing United States steel piling.

U. S. Metal & Manufacturing Co., New York.—Victor car replacers, "Perfect" car replacers, Columbia lock nuts.

Variety Manufacturing Co., Chicago.—Models of Cross freight elevator door and folding roundhouse door.

Walters & Okell, Fort Madison, Iowa.—Sample of Walters ballast placing device.

C. H. Whall & Co., Boston, Mass.—Samples of Whall special railroad insulating fibre.

## Grain Storage Agreement.

The New York trunk lines, after a long period of negotiations, have reached an agreement about the storage and handling of grain at New York, effective April 1. The agreement is signed by the New York Central, the Erie, the Pennsylvania, the Lackawanna, the Lehigh Valley, the Ontario & Western and the Baltimore & Ohio. The New York Produce Exchange is also a party to it. The agreement defines the inspection, grading, consolidation and delivery of all grain arriving by rail and provides that the railroads may put together in elevators, warehouses, boats or barges, provided by themselves for the purpose, grain of the same kind and grade without regard to its ownership, after it has been inspected and weighed, as specified; although receivers of grain have the right to preserve the identity of ex-lake grain if they care to, and shippers have the right to preserve the identity of all rail grain consigned to this market, subject only to such uniform conditions as may be made by the railroads. Arbitration of questions at dispute is provided. The railroads will issue grain certificates for quantities not to exceed 5,000 bushels for each certificate. These cer-

tificates shall be properly dated and consecutively numbered, and shall state in detail the kind, grade and quantity of grain they represent. They shall be furnished to the consignees before noon of the dates specified, accompanied by freight bills, and with inspection returns. These certificates may, however, be withheld by the railroads until bills of lading covering the property have been surrendered. All bulk grain, including that in bond arriving in cars at the terminus of any of the railroads in the agreement and delivered in accordance with it may be inspected, sampled or graded by the New York Produce Exchange.

Where grain is consigned "not to be graded" or for track delivery, and is held in cars and subsequently ordered for other track delivery, or to boats or elevators, or for delivery by carfloat or lighter, the railroad shall collect not less than $3 per car (plus car service if incurred) for reconsignment privilege to cover the cost of extra switching, etc., involved, provided such delivery order is not filed with the carrier within 24 hours (Sundays and holidays excepted) after the car ticket has been lodged with the grain inspector at the point of inspection. All cars not ordered within 72 hours may be put afloat in grain boats, direct or through elevators. All grain held on track awaiting orders from consignee or for unloading will be subject to a car service charge of $1 per car per day or fraction thereof, if not ordered or unloaded at the expiration of 72 hours after 12 noon of the day of arrival. Consignees who wish to have grain (received on railroad bills of lading subject to free lighterage) remain in elevator on storage shall receive elevator receipts for same, and such grain will be granted free lighterage on delivery from elevator; provided, however, notice to store be given in writing before such grain is received in elevator. After such grain is delivered from the elevator it will be allowed (exclusive of the day of ordering, Sundays and legal holidays) three days, including that of its arrival (prior to 6 p.m.) at a specified point of destination, free of charges; after that time demurrage shall accrue at one-sixteenth of one per cent. per bushel per day, or part thereof, until the grain is discharged, but the demurrage charge on any one order for any one kind or grade of grain shall not be less than $6 per day or part thereof. In computing the number of days consumed in discharging grain from boats an additional day shall be counted for all boats discharged after 7 p.m.

Grain delivered to ocean vessels direct from railroad elevator, ½ cent per bushel.

Screening and blowing one-eighth of a cent per bushel. On all grain blown and screened to lighters for harbor delivery shortage in excess of one bushel per thousand bushels will not be guaranteed.

Mixing grain, one-eighth of a cent per bushel to be charged upon each bushel forming the mixture.

Transferring grain while in store, one-eighth of a cent per bushel.

Clipping oats, one-half cent per bushel.

Vessels or canal boats loading at the railroad elevators are to pay usual charges for shoveling and trimming.

Delivery in bags, including sewing or tying, with specific weight in each bag, 1½ cents per bushel. Delivery in bags, including sewing or tying, without specific weight in each bag, 1 cent per bushel.

Form 53.

**THE ..... RAILWAY COMPANY.**

WATCH REGISTER.

.....Station

From 12 01 A. M.....190....to 12 01 A. M.....190....

TO BE SENT TO THE SUPERINTENDENT DAILY.

NOTE—If a watch is 30 seconds fast or slow it must be SET correct with the standard clock, and before making a second Trip the Watch must be taken to the Watch Examiner.

| CONDUCTORS | | | | | | ENGINEMEN | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NAMES | No. of Train | Time Compared | Seconds Slow | Seconds Fast | Were Hands Changed? | NAMES | No. of Engine | Time Compared | Seconds Slow | Seconds Fast | Were Hands Changed? |
| | | | | | | | | | | | |
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(Form 8½ in. wide.)

## Standard-Code Rules

*Should not there be a Revision of those for Single Track?*

BY H. W. FORMAN,
Author of "Rights of Trains on Single Track."

(*Concluded from page 266.*)

FORMS OF TRAIN ORDERS.

Instead of trying to accomplish the somewhat difficult feat of starting a train from Naples, Italy, and annulling it between Halifax, Nova Scotia, and Juneau, Alaska; or embarrassing trainmen who cannot properly pronounce such names as Astrakhan, Teheran, and Khartoum, how much better it would be to make use of the letters of the alphabet in making the examples. Such letters have what may be called natural sequence and are admirably adapted for this purpose. Also, why not number the forms, instead of designating them as Form A, B, C, etc.?

FORM NUMBER 1. FIXING MEETING.

EXAMPLES.

(1.) *No 1 will meet No 2 at B.*
(2.) *No 3 will meet 2d No 4 at B.*
(3.) *No 5 will meet Extra 95 East at B.*
(4.) *Extra 652 East will meet Extra 231 West at B.*
(5.) *No 1 will meet No 2 at B 2d No 4 at C and Extra 95 East at D.*

Trains receiving these orders will run with respect to each other to the designated points, and there meet in the manner provided by the rules.

FORM NUMBER 2. DIRECTING A TRAIN TO PASS OR RUN AHEAD OF ANOTHER TRAIN.

EXAMPLES.

(1.) *No 1 will pass No 3 at B.*
(2.) *No 6 will pass No 4 when overtaken.*
(3.) *Extra 594 East will run ahead of No 6 A to D.*
(4.) *No 15 will pass No 3 at C and run ahead to Z.*
(5.) *No 15 will run ahead of No 1 until overtaken.*
(6.) *No 15 will run ahead of No 1 A to Z unless overtaken.*

When, under Example 1, a train is to pass another, both trains will run according to rule to the designated point and there arrange for the rear train to pass promptly.

Under Examples 2, 5 and 6, both trains will run according to rule until the train in advance is overtaken at some siding and there arrange for the following train to pass promptly.

Under Example 3 the second-named train must not exceed the speed that is ordinarily maintained by trains of the character of the one first-named between the points designated.

FORM NUMBER 3. GIVING A TRAIN THE RIGHT OVER AN OPPOSING TRAIN.

EXAMPLES.

(1.) *No 1 has right over No 2 E to H.*
(2.) *Extra 37 East has right over No 3 H to E.*

This order gives the train first named the right over the other train between the points named.

If the trains meet at either of the designated points, the first-named train must pull into siding, unless the order otherwise prescribes.

Under Example 1, if the second-named train reaches the point last named before the other arrives it may proceed, keeping clear of the opposing train as many minutes as such train was before required to clear it under the rules.

If the second-named train, before meeting, reaches a point within the limits named in the order, the conductor must stop the other train where it is met and identify his train.

Under Example 2 the regular train must not pass the point last named until the extra train has arrived.

It is not thought necessary to consider the behavior of the trains outside of the limits designated in the order, and the code rule as worded is unsound technically in this respect, because the principle is not made to apply to territory on both sides of that in which the superiority of the trains is reversed. So far as the rule goes, the theory is correct, but it is not practicable; nor can it always be complied with, as the trains may meet beyond the limits on double-track between stations. For this reason it would be better to omit from the fourth paragraph of the code rule the words "or beyond." When, on account of only one restricting order being issued, it is necessary to give notice beyond the train order limits mentioned, it may be regarded as another distinct movement and be taken care of as circumstances require. There may be train registers at the points designated. The sixth paragraph of the code rule reading "when the extra train has reached the point last named the order is fulfilled" is misleading and of doubtful soundness, and should be dropped. If the order is addressed to No. 3 it is not fulfilled until delivered to that train. It would not be difficult for the operator at the last-named station to construe this to mean that he may destroy an order containing the words "instead of" when the extra arrives and thus cause a tie-up, should No. 3 hold other orders of which he is not aware restricting it for the extra at some station within the limits.

The example giving a work extra right over all trains will be found further on in the form prescribing orders for work trains. It properly and logically belongs there.

Fully 90 per cent. of the railroad men who have considered Form D, giving regular trains the right over a given train, will agree that it is unnecessary and should by all means be discarded. It is rarely used, except, possibly, on double-track in case of obstruction of one of the tracks and even then it is not needed, because the standard code for double-track has a better form for such emergencies. When, under Code Form C, one

train is given right over another, the train thus made inferior must clear the other train's time as many minutes as such train was before required to clear it under the rules. But in Form D the train over which right is given must clear all classes of trains five minutes. This is necessary, of course, but does not prevent men from constantly getting the better theory of Form C tangled up in their minds.

FORM NUMBER 4. TIME ORDERS.

EXAMPLES.

(1.) *No* 1 *will run* 20 *mins late A to E.*

(2.) *No* 1 *will run* 20 *mins late A to E* 15 *mins late E to H etc.*

(3.) *No* 1 *will wait at E until* 10 *a m for No* 2.

(4.) *No* 1 *will wait at E until* 10 *a m.*

Examples 1 and 2 make the schedule time of the train named, between the stations mentioned, as much later as stated in the order; and any other train receiving the order is required to run with respect to this later time, as before required to run with respect to the regular schedule time.

Under Example 3 the train first named must not pass the designated station before the time given, unless the other train has arrived. The train last named is required to run with respect to the time specified, as before required to run with respect to the regular schedule time of the train first named.

Under Example 4 the train named must not pass the designated station before the time given. Any opposing inferior train receiving the order will run with respect to this later time as before required to run with respect to the regular schedule time of the train named.

(5.) *No* 1 *will run on the following schedule*:

*Leave A* 11 30 *p m*
" *B* 12 25 *a m*
" *C* 1 47 *a m*
*Arrive D* 2 25 *a m*

Example 5 makes the schedule time of the train named, between the stations mentioned, as shown in the order, and any inferior train receiving the order is required to run with respect to this later time as before required to run with respect to the regular schedule time.

This form must not be used to run a train ahead of its regular schedule.

I believe Example 5 should be added for the following reasons: When a train is run late there must be an allowance made for it to recover time. To enable it do so, the despatcher is required to drop five or ten minutes at a great many stations, and this makes it difficult to keep other important trains moving on a close margin of time ahead of or against the train which is off its schedule. Again, it is less difficult for the men in charge of the train which is late to determine when they may pass stations, as they do not have to add minutes to their time-table time. Inferior trains also enjoy this advantage in finding the hour at which the superior train must be cleared at each station. After a despatcher has worked on a district for a few weeks he knows within a minute or two the time that a delayed train can recover between each two stations and can figure out a late schedule that will allow freight trains to move ahead or of against the superior train as closely as they could work against its time-table time.

FORM NUMBER 5. CREATING SECTIONS.

EXAMPLES.

(1.) *Eng* 20 *will display signals and run as* 1*st No* 1 *A to Z.*

(2.) *Eng* 30 *will run as* 2*d No* 1 *A to Z.*

(3.) *Engs* 20 30 *and* 40 *will run as* 1*st* 2*d and* 3*d No* 1 *A to Z.*

(4.) *No* 1 *will display signals A to E for Eng* 30.

(5.) 2*d No* 1 *will display signals A to E for Eng* 40.

CHANGING SECTIONS.

EXAMPLES.

(6.) *Eng* 30 *is discontinued as* 2*d No* 1 *from E.*

(7.) *Eng* 20 *is discontinued as* 1*st No* 1 *from E following sections will change numbers accordingly.*

(8.) *Eng* 20 *is discontinued as* 1*st No* 1 *from E. Eng* 30 *will run as* 1*st No* 1 *E to Z.*

(9.) *Engs* 20 *and* 30 *are discontinued as* 1*st and* 2*d No* 1 *from E. Engs* 30 *and* 20 *will run as* 1*st and* 2*d No* 1 *E to Z.*

The character of a section may be stated. Each section affected by the order must receive copies, and must arrange signals and numbers accordingly.

Under Example 2, 2d No 1 is not required to receive the information given in Example 1. Under Example 4 1st No 1 must take down its signals at E.

Under Example 6 1st No 1 must take down its signals at E; or, if it receives the order after passing E, it must at once take them down. Engine 30, or any other, may be again created as 2d No 1 between E and Z.

Under Example 7 it must be understood that the first section of the schedule is discontinued from E, and following sections are advanced one number; that is, 2d No 1 then runs as 1st from E, and so on. Under Example 8 1st No 1 is not discontinued; the right to run as 1st No 1 is transferred from engine 20 to engine 30.

Under Example 9 it must be understood that the 2d section must pass the 1st at E and the 1st becomes 2d from E; both sections will change numbers and arrange signals accordingly.

I will discuss this form further in connection with that which anuuls a train.

Form 54.

**THE.....RAILWAY COMPANY.**

Register of Trains ARRIVED at..... Station.....190....

| Train | Road | Engine | Signals | Time Arrived | Cars: Pass. | Cars: Stock | Cars: D. F. | Cars: Empties | Tons | Conductor | Caboose | Engineman |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

(Form 12 in. wide.)

Register of Trains DEPARTED from..... Station.....190....

| Train | Road | Engine | Signals | Time Departed | Cars: Pass. | Cars: Stock | Cars: D. F. | Cars: Empties | Tons | Conductor | Caboose | Engineman |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |

(Form 12 in. wide.)

FORM NUMBER 6. EXTRA TRAINS.

EXAMPLES.

(1.) *Eng* 99 *will run extra A to E.*

(2.) *Eng* 99 *will run extra A to E and return.*

(3.) *Eng* 99 *will run extra A to E and return to B.*

Extra trains are not required to protect against opposing extras, unless directed by order or rule to do so, but must clear regular trains as the rules require.

(4.) *Eng* 77 *will run extra leaving A on Thursday Feb* 17*th as follows with right over all trains.*

*Leave A* 11 30 *p m*
" *B* 12 25 *a m*
" *C* 1 47 *a m*
*Arrive D* 2 22 *a m*

This order may be varied by specifying the kind of extra and the particular trains over which the extra shall or shall not have the right. Trains over which the extra is thus given the right must clear the time of the extra five minutes.

FORM NUMBER 7. WORK EXTRA.

EXAMPLES.

(1.) *Eng* 292 *will work extra* 7 *a m until* 6 *p m between A and B.*

Under (1), the work extra must, whether standing or moving, protect itself within the working limits in both directions as prescribed by Rule 99. The time of regular trains must be cleared.

The above form may be combined with one similar to the following:

(2.) *Without protecting against eastbound extra trains.*

(3.) *Without protecting against extra trains.*

Under Example 2 the work extra will protect only against westbound extra trains. The time of regular trains must be cleared.

Under Example 3 protection against extra trains is not required. The time of regular trains must be cleared.

Whenever extra trains are run over working limits, they must be given a copy of the order sent to the work extra. Should the working order instruct a work extra not to protect against extra trains in one or both directions, it will then be the duty of extra trains to protect, as prescribed by Rule 99, against the work extra; if the order indicates that the work extra is protecting itself against extra trains, they will run expecting to find the work extra protecting.

When a work extra has been instructed by order not to protect against extra trains and, afterward, it is desired to have it clear the track for (or protect itself after a certain hour against) a designated extra, an order may be given in the following form:

(4.) *Work extra* 292 *will keep clear of (or protect against) Extra* 76 *East between A and B after* 2 10 *p m.*

Under Example 4 Extra 76 East must not enter the working limits until 2:10 p. m., and then run expecting to find the work extra clear of the main track (or protecting itself) as the order may require.

(5.) *Work extra* 292 *will protect against No* 55 *(or all regular trains) between A and B.*

Under Example 5 the work extra may work upon the time of the train or trains mentioned in the order, and must protect against such train or trains as prescribed by Rule 99. The regular train or trains receiving the order will run expecting to find the work extra protecting.

When a work extra is given an order to protect against all regular trains except, say first or second class trains, it must clear the time of the regular trains excepted.

Work extras must give way to all trains as promptly as practicable.

(6.) *Work extra* 292 *has right over all*

Form 55.

(Page of Bulletin Book.)

12 inches. 10½ inches.

Above received and posted.....M. on.....190..
The above Instructions have been read, and are Understood.

| Name | Date | Name | Date | Name | Date |
|---|---|---|---|---|---|
| | | | | | |
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½ inch

For ways that are dark and tricks that are vain Form J is certainly peculiar. It is not difficult to construe it in two ways: the holding orders, and the releases, must, or need not, be delivered to trains. If you were a conductor, how would you like to come into a telegraph station, find the train order signal at "stop," and be informed by an operator who perhaps was employed only that day, that he had an order to hold your train; and, later, be told by him that now you could proceed; that the holding order had been annulled, or that he had received a "may go," indicating that the despatcher had no occasion to send an order for your train? And all of this without your receiving a copy of the instructions. This is the generally accepted meaning of the rule. The other and (to me) better way is to require that copies of the holding orders and the releases be delivered to the trains interested, and acknowledged in the usual manner. He will deliver copies to trains which he is directed to hold without taking signatures. It must be respected by conductors and enginemen of trains thereby directed to be held as if addressed to them.

When a train has been so held, it must not proceed until the order to hold is annulled, or an order is given to the operator in the form: "———— *may go.*"

Copies of these orders will also be delivered to trains which the operator was directed to hold, but without obtaining signatures.

Form J will only be used when necessary to hold trains until orders can be given, or in case of emergency.

FORM NUMBER 8 (B). HOLDING ORDER.

EXAMPLES.

(1.) *Hold No* 2.
(2.) *Hold all eastbound trains.*

This order will be addressed to the operator and acknowledged in the usual manner. It must be respected by conductors and enginemen of trains thereby directed to be held as if addressed to them, but need not be delivered to them.

When a train has been so held it must not proceed until the order to hold is annulled, or an order given to the operator in the form: "———— *may go.*"

Operators are not required to deliver copies of the annulling order or the "———— may go," order.

Form J will only be used when necessary to hold trains until orders can be given, or in case of emergency.

Form 56.

## TRAIN REGISTERING TICKET.

.....Station .....190..

.....Section Train No. ...Eng.....Displaying.....Signals

Arrived.....M., Departed.....M.

Stock.....Dead Freight..... .....Empties.....Tons.....

Mail.....Bags.....Coach.. ..... Diner.....Sleeper.....Spl.....

.....Conductor.

Conductors will fill out and leave one of these tickets at designated telegraph stations, and as required by Rule 906.

(Form 5½ in. wide, 2½ in. high.)

**Proposed Standard Forms.**

*Form K.*—This form, for annulling a regular train illustrates the truth that it is not difficult for a body of men, who can quickly discern the application of a principle by reason of years of training and investigation, to formulate rules which are clear to them, but which are nevertheless valueless unless the men who are to be governed by

*trains between A and B from 7 p m until 12 midnight.*

Under Example 6 the work extra has the exclusive right between the points designated, between the times named.

(7.) *All eastbound trains, except first class, will wait at B until 3 p m for work extra 292.*

Under Example 7 the work extra has the exclusive right over all eastbound extra and regular trains, except first class trains, to the points designated, until the time named.

If the plan of making a work extra protect itself at all times against other extra trains, unless ordered not to do so, is not thought to be the better, the proposed rules can be made to embrace the opposite view by slightly changing the wording; but, whatever form may be adopted, the wording should be of duplex meaning, that is, when an extra train receives an order indicating that a work extra is not protecting against it, this order should be all sufficient to compel the extra to protect against the work extra.

It will be noticed that, with the exception of the single-order practice found in code Form H, the theory of the rules throughout is that when one train is restricted the same order is understood to, if necessary, confer right upon some other train.

so that they may have something to show that they had respected the signal and also had been properly released from it. But there will always be circumstances under which the copies cannot be delivered to trains without unnecessary delay, and in order to fully meet every condition, two forms are recommended as follows:

FORM NUMBER 8 (A). HOLDING ORDER.

EXAMPLES.

(1.) *Hold No* 2.
(2.) *Hold all eastbound trains.*

This order will be addressed to the operator

Form 59.

## OPERATOR'S TRANSFER.

The following Train Orders and Messages are outstanding at..... .....Station upon the date and at time noted.

| Date 190.. | Time | Train Orders: Specify each order by its number | Overdue Trains | Messages | To Whom Addressed | Signatures of Operators: Operator Relieving | Operator Relieved |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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(Form 11 in. wide and of height suitable for a convenient book.)

such rules also quickly and fully comprehend their meaning.

The Standard Code has been successful because, in the main it is clear, simple and practical, but it cannot yet be called perfect. One of the difficult things an instructor of men has to contend with is in trying to explain to them how a section of a train can be annulled by its engine number; or how it can be annulled and at the same time another section be allowed to move up and run as the section which the order says is annulled.

While there is but little difference in the meaning of the words "annulled" and "discontinued," it is, nevertheless, desirable to use the former only when a train is actually ordered out of existence to remain so during the life of the schedule which it was using; and apply the latter term only in cases where a train shall for the time being surrender its authority to make its trip.

Form A.

(To be printed on red paper.)

.....COMPANY.

CLEARANCE CARD.

Dover. 9 15 A. M. March 25. 1905.

Conductor and Engineman No. 12.

I have no (further) orders for your train.

This does not interfere with or countermand any orders you may have received.

John Jones.

Operator.

Conductor and Engineman must each have a copy, and see that their train is correctly designated in the above form.

It is often claimed that while a schedule may be annulled, a train cannot be, because it is an ever existing and physical fact. But this is not good reasoning. An engine may be coupled to a lot of cars with a caboose at the rear and all train signals properly displayed and still be nothing but rolling stock, until made a train by a train order or a clearance card. Or a conductor may report at an office and obtain an order for an engine to run extra, before such engine is out of the house or fired up; but we must take this extra into account from the moment it is thus created. Take away from that conductor his authority to occupy the main track and again we have nothing but a man. It is entirely proper and often necessary to provide for the annulment of either a schedule or a train; I consider the men in charge of a train as a very necessary part of it and have proposed a definition for a train embracing this view.

Up to the present time all the clamor has been to change Form F to read "discontinued," instead of "annulled," and use Form K exclusively to annul schedules. This leaves the code rules in such shape that sections and extra trains cannot be annulled. According to Rule 220, when No 4 is directed to meet 2d No 1, it must wait for this section until it loses its schedule or is annulled, unless directed to move against it by an order containing the words "instead of." It no more could find authority to disregard 2d No 1 when an order was given to it that 2d No 1 was discontinued, than it now can find authority to move against such train when an order is issued reading "Eng 30 is annulled as 2d No 1 from E." The contention has always been that, while Engine 30 is annulled as that section, there is nothing to prevent the despatcher from authorizing some other engine to run as 2d No 1 from E. It settles nothing for me to understand that this effectually annuls the section; we must consider the possible interpretation that the men who are moving the trains may put upon it.

The proposed change in Form F is made with the view to allowing a section to be discontinued without so hampering the despatcher that he cannot re-create it in the territory over which it has not been run. It is necessary also to provide him a means whereby he can when necessary annul a train.

Nor am I ready to admit that the only way an extra train can be killed is to annul the order which created it. There are times when it is entirely safe and proper, and saves orders, to annul the extra outright. There is always a chance of an order number being wrong, and thus failing to abrogate a section or an extra when a certain order is annulled by its number alone.

FORM NUMBER 9. ANNULLING A SCHEDULE OR A TRAIN.

EXAMPLES.

(1.) *No 1 of Saturday Feb 29th is annulled A to Z.*

(2.) *2d No 1 of Saturday Feb 29th is annulled E to Z.*

(3.) *No 1 due to leave A Saturday Feb 29th is annulled E to Z.*

When a schedule or a train has been annulled, it must not be restored between the stations named.

It is highly important that the day of the week be always mentioned when a schedule of a train is annulled.

FORM NUMBER 10. ANNULLING AN ORDER.

EXAMPLE.

*Order No 10 is annulled.*

An order which has been annulled must not be reissued under its original number.

If an order which is to be annulled has not been delivered to a train, the annulling order will be addressed to the operator, who will destroy all copies of the order annulled but his own, and write on that:

*Annulled by Order No.....*

FORM NUMBER 11. ANNULLING PART OF AN ORDER.

EXAMPLE.

*That part of Order No 10 reading No 1 will meet No 2 at B is annulled.*

FORM NUMBER 12. SUPERSEDING AN ORDER OR A PART OF AN ORDER.

This may be done by adding to prescribed forms, the words "instead of ————."

EXAMPLES.

(1.) *No 1 will meet No 2 at E instead of B.*

(2.) *No 1 has right over No 2 A to Z instead of E. (or instead of meeting at E.)*

(3.) *No 1 will display signals for Eng 30 A to Z instead of to E.*

An order which has been superseded must not be reissued under its original number.

I have omitted the paragraphs of the explanations of Code Forms L and M, beginning "In the address of an order annulling, etc." There are two reasons why this seems advisable: The point is a mere detail which must be known to a train despatcher; and as at present worded there is a chance for a misunderstanding. It is not enough for a despatcher to send the order first to the station where the superior train is to receive it, unless such station happens to be the initial one as, otherwise, he might cause a collision by allowing the train made inferior by the order to come to or pass the point where the annulling order was awaiting the other train before it acknowledges it. If some such requirement is thought necessary, it would be better to make it somewhat more explicit, as the following: "In annulling an order or a part of an order, acknowledgment must be obtained from the conductor of the train to which right was given by the order or part of order annulled, before it is completed for other trains."

Form B.

(To be printed on yellow paper.)

(Name) COMPANY.

CLEARANCE CARD.

Dover. 9 15 A. M. March 25. 1905.

Conductor and Engineman No. 12.

I have no (further) orders for your train.

Train Order Signal is displayed at stop for Extra 452 East.

This does not interfere with or countermand any orders you may have received.

John Jones.

Operator.

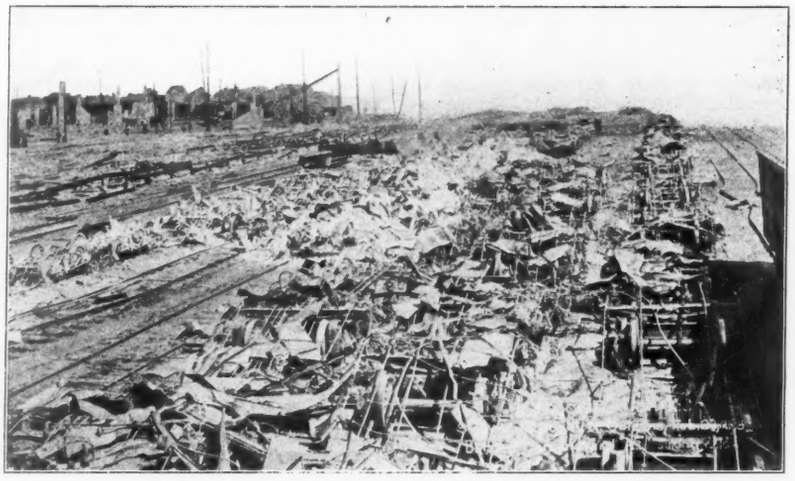
Conductor and Engineman must each have a copy, and see that their train is correctly designated in the above form.

Standard Code Forms 19 and 31 are defective in that there is not enough room to address the orders to all the trains which are ordinarily included in a movement. The address space, beginning with "To" should have two lines extending the full width of the form. The Clearance-Card is presented herewith in a slightly modified form. The other forms are, in my opinion, a necessary part of the Code.

## Fire Protection of the Stuyvesant Docks.

BY H. W. PARKHURST.

The destruction by fire of the Stuyvesant docks of the Illinois Central at New Orleans on Sunday, February 26, was noted in the *Railroad Gazette*, March 3. A brief illustrated description of these docks was printed in these columns May 13, 1904. The property consisted of nearly a mile of wharf extending along the river from Louisiana to Napoleon avenues. This wharf was covered by a shed, and was used for storage and receiving and shipping cotton, timber, grain and much miscellaneous freight. Back of the wharf and parallel with it, were two long brick freight houses divided into sections for storing flour, cement, etc. Back of the freight houses were two elevators of 1,000,000 bu. and 1,500,000 bu. capacity respectively. These were connected by conveyor galleries and belts, so that seven different ships each 400 to 500 ft. long, stationed along the wharf, might be loaded simultaneously with grain at the rate of 20,000 bu. an hour, on a single belt. Still further back, next to the town side, was a large cotton warehouse. The wharves, freight houses, elevators, etc., were surrounded with receiving and shipping tracks and storage yards. There were also many minor buildings, the whole representing an outlay of about $2,500,000, exclusive of the value of the land.



Burned Cars in Yard A, Stuyvesant Docks, Looking East.

The fire, supposed to have been of accidental origin in one of the conveyor galleries, gathered such headway that in less than eight hours nearly the entire property was a mass of ruins. It naturally occurs to the engineer to ask whether such a catastrophe was feared, and what provision was made to prevent it.

The article of May 13, 1904, alludes to Niagara hydrants, a special waterworks system and powerful pumps, all for fire protection. But this brief reference does not do justice to the provisions made for fighting fire. While in the power house of each elevator there was installed a very powerful pump, a special pumping station was also built, equipped with boilers and several large pumps, which were connected with water mains laid the whole length of the wharves, about the elevators and in the yards. Upon these mains hydrants were placed, each of which was equipped with a long length of hose in place and additional hose was furnished on reels ready for use.

The pumps received water from either of three sources: (1) Two deep artesian wells, each having a capacity of several hundred thousand gallons a day; (2) direct suction from the river, and (3) auxiliary head from two 100,000-gal. tanks set in towers, one near each elevator. An extensive system of large water mains with smaller branches was laid throughout the whole property, and ordinary 2½-in hydrants were placed at intervals of about 200 ft. on the wharf and 50 ft. in freight houses. Numerous other hydrants were distributed about the yards. Twelve Niagara hydrants, located advantageously, were also connected to these mains, each capable of throwing a 3-in. stream 200 ft. Each elevator had two 20,000-gal. tanks on its top, connected with an interior system of pipes and supplied with hose, stop-

Fire Wall No. 1 After the Fire.

East Storehouse and Adjacent Wharf.

Power House—Elevator D.

Ruins of Elevator D, from the South.

cocks, etc., throughout the elevator. In addition, Elevator E was completely equipped with a sprinkling apparatus which was extended about 100 ft. into each of the conveyor galleries.

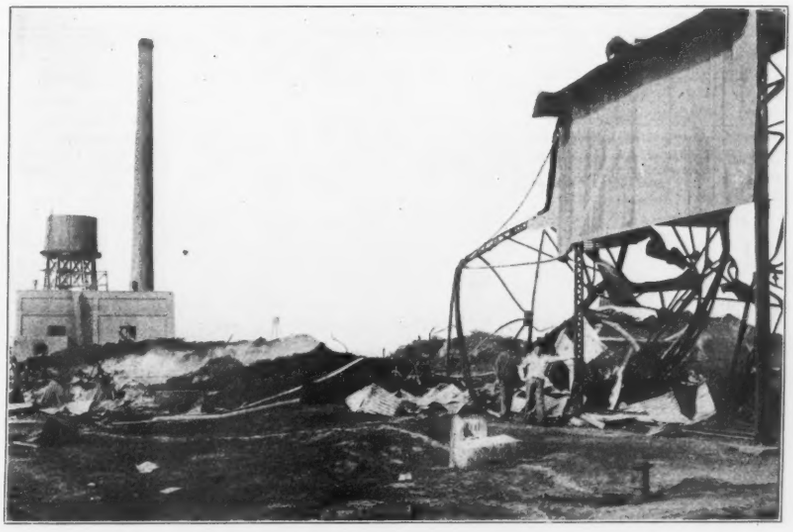
So much for means to fight a fire. To prevent its spreading, or to confine it, the wharf was divided into four sections by three fire-walls, one of concrete near the middle on a separate pile foundation, and the other two of tile, with a small amount of concrete. These were furnished with fire doors to work automatically, and it was hoped that any one of them might arrest a conflagration.

Each freight warehouse was divided into sections of about 120 ft. by brick fire walls. An unusually large number of water barrels and water buckets were systematically disposed and kept in good working order. The forces employed were trained to a fire drill, and upon an alarm being given, were accustomed to take their proper stations and get out hose or other appliances in readiness to fight a fire. That these precautions effectually prevented any conflagration for over eight years shows that they were not taken in vain. It had always been asserted by the superintendents that if a fire once got under full headway, it would be impossible to stop it. The wharfs were built of yellow pine piles and timber. The shed on the wharf was also yellow pine, and the larger proportion of merchandise stored in it was of combustible character. It was covered with fire proofing but was all open to the wind, which would materially increase the fury of a blaze.

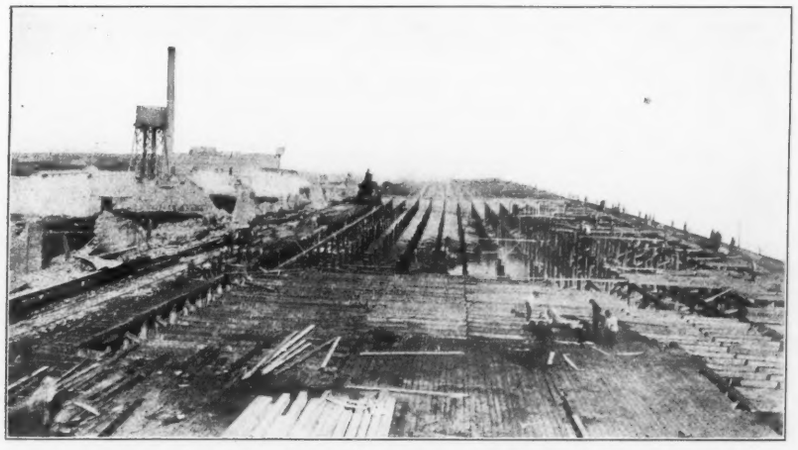
The long conveyor galleries—nearly the whole length of the front of the wharf, and connected at four places back to the elevators—were regular flues to distribute the fire. An attempt was made to reduce the danger from these conveyors, by making several intermediate sections of fire-proof character. Automatic aprons were proposed, but I think never built, to close the fire-proof sections in case of fire. Eye witnesses state that while the hydrants on the wharf were at first useful, the men who used them were driven away by the fire and left them running, so that although the pumps were uninjured and were run continuously, the water was wasted and no stream could be thrown with force.

The special pumping plant is intact and uninjured, although it was in the fiercest part of the fire. Also, the up-stream end of the wharf was saved from burning by a change in the wind. The power house at Elevator E, which was brick and entirely separate from the elevator, with nearly all the machinery in it was saved from destruction. A large proportion of the tracks was also saved. The river being low, the wharf shed and the piles supporting it and the bulkheads were pretty completely destroyed. The brick freight houses are a mass of ruins from which probably, however, most of the foundations may be utilized.

A contract has been let to rebuild Elevator E, and the railroad company is using its own forces, with outside help, to drive piles for the bulkhead and wharf and to rebuild the same. An effort will be made to have the new construction more fire-proof than the old; but a serious question at once arises, which will probably remain unanswered, namely: How much is a railroad company justified in spending for fire-proof buildings in which to store combustible merchandise? The fact that the goods stored must be handled promptly complicates the problem. Undoubtedly the same class of combustible structures, with now and then a fire-proof feature introduced, will continue to be used to store and handle commercial products.



Ruins of Elevator E.



Flooring New Wharf After the Fire.

## Accident in the Battery Tunnel.

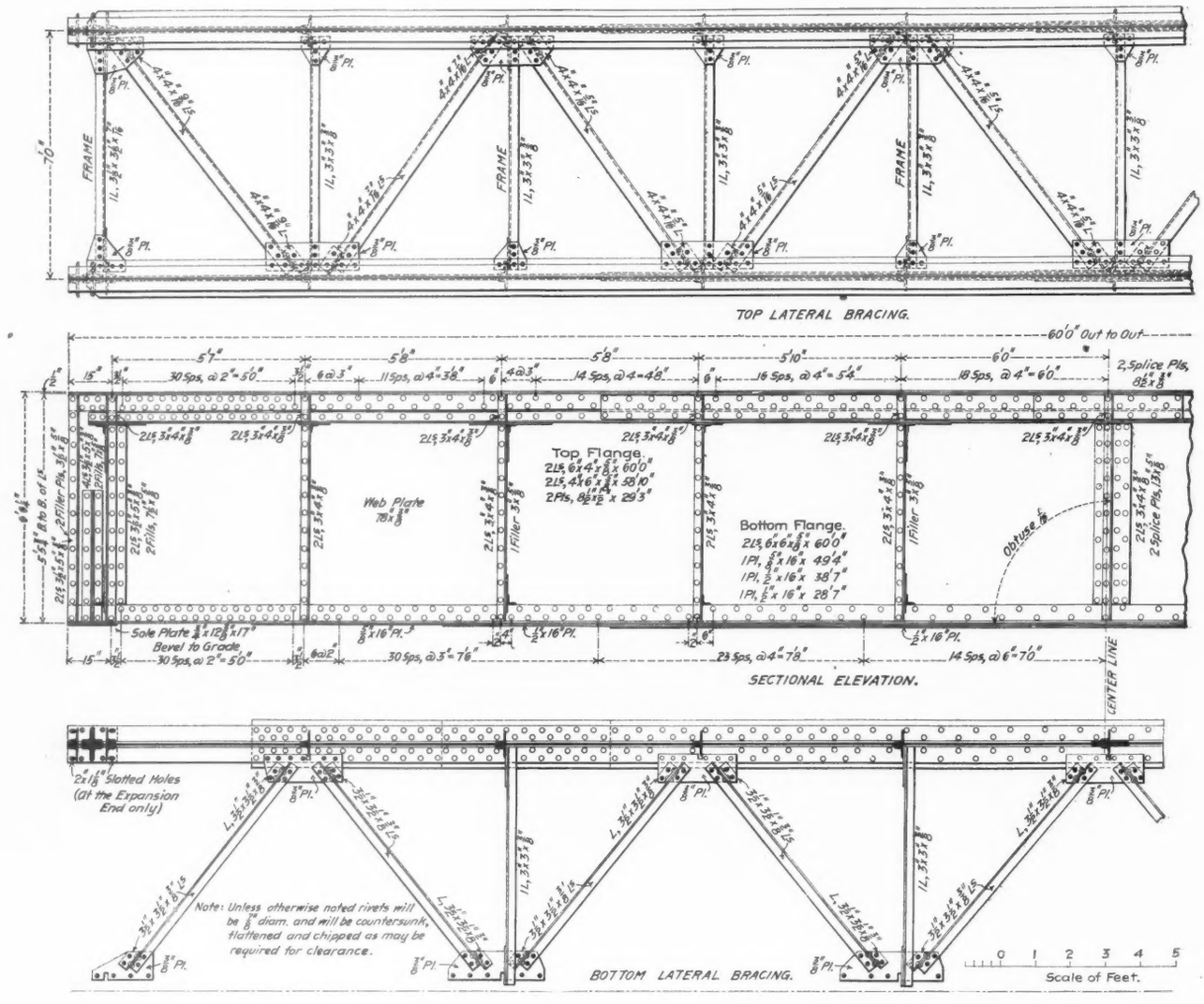
A remarkable and unprecedented accident occurred early Monday morning, March 27, in the Brooklyn heading of the Rapid Transit Tunnel under the East River, which extends from the Battery on Manhattan Island to the foot of Joralemon street, Brooklyn, and will form the connection between the Subway system in New York and Brooklyn. The tunnel, which will be a two-track metal tube lined with concrete, is being driven simultaneously from both sides of the river, and has been advanced about 200 ft. out from the bulkhead line at the Brooklyn end. The river bottom is silt and mud with occasional boulders and some small pockets of quicksand, and the work has advanced rapidly without difficulty by the usual Greathead shield method under air pressure. On Monday morning four workmen were in the advance heading in front of the shield excavating for the top drift. According to their

story, the air pressure was about 16 lbs. and no trouble with blows had been encountered since they had come into the heading some hours before. About 8 o'clock one of the men detected a small blow near the edge of the apron down on one side by the hissing sound of the escaping air. He and the other three men located and stopped the leak with sand bags kept in the heading for such emergencies and began work again. Another blow under the top of the apron opened shortly afterwards and before it could be stopped the water and mud began to come into the chamber. William Creegan, who was on the working platform under the roof, attempted to close the break with straw bags, but the rush of the escaping air drew him into the hole and out beyond the apron. The temporary plugging of the hole by his body allowed the air pressure to rise in the shield with sufficient force together with his own struggles to carry him up through the five feet or more of mud which covered the top of the tunnel. Once clear of the mud he was carried up through 15 ft. of water and lifted several feet in the air on the column of water forced up from the river by the escaping air. He retained consciousness during his journey upward and on striking the water again began to swim. When picked up by a boat which put out from the shore he was apparently uninjured and suffered from nothing but the shock. His companions in the heading were rescued by the men behind the shield who heard the sound like an explosion when the blow occurred. They were stunned by the sudden drop in the air pressure but not otherwise hurt. The temporary plugging of the hole by Creegan's body prevented the immediate rush of mud and water following the rush of escaping air and allowed the men back of the shield to get three men out of danger and close the lock in the shield before the compartment was flooded completely. No damage was done to the tunnel beyond filling the advance heading with mud and work will be resumed at once.

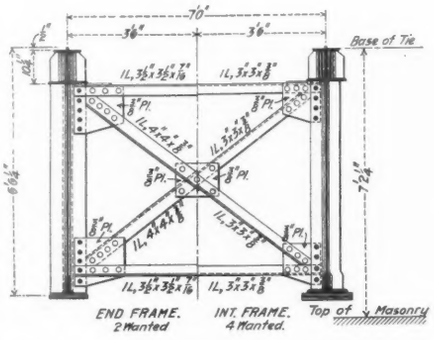
## Standard Bridges on the Harriman Lines.*

The accompanying drawings show the standard 60-ft. deck plate girder for single-track which differs but slightly from the 50-ft. span shown last week. Bottom lateral bracing of 3½-in. x 3½-in. x ⅜-in. has been added, however, and cast-steel bed plates are put under the ends of the girders in place of a flat wall plate. The depth of the girders has been increased to 6 ft. 5¾ in., and heav-

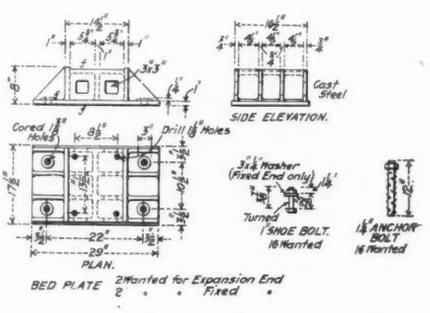
*Previous articles giving the general specifications for stone bridges and drawings of the standard 20, 30, 40 and 50-ft. plate girder spans on the Harriman Lines appeared in the *Railroad Gazette*, March 17 and 24.


TOP LATERAL BRACING.
60'0" Out to Out
Top Flange.
Web Plate
Bottom Flange.
SECTIONAL ELEVATION.
CENTER LINE
Note: Unless otherwise noted rivets will be ⅞" diam. and will be countersunk, flattened and chipped as may be required for clearance.
BOTTOM LATERAL BRACING.
Scale of Feet.

General Drawing of Standard 60-ft. Deck Plate Girder Railroad Bridge, Harriman Lines.




Details of Cross Frames for 60-ft. Girder.




Details of Bed Plate for 60-ft. Girder.

ier flange angles and cover plates have been used in the flanges. The area of metal in the top flange is 35.78 sq. in., and in the bottom flange 42.47 sq. in. The estimated weight of one span is 47,500 lbs.

## The Cost of Locomotive Operation.

IV.

*With an Inset.*

BY G. R. HENDERSON.

(*Continued from page 225.*)

FUEL.

*Useful Work.*—The items heretofore considered have been mostly connected with the waste of fuel, and were introduced to impress upon the reader the many difficulties to be overcome in order to observe strict economy. While these all have a great influence upon the cost of the service, it is a fact that only the proper amount of fuel is consumed in doing the work of the train that is required by the laws of nature—the balance is burned in an attempt to make up for leaks and other deficiencies in maintenance or operation of the engine; that is to say, that a given amount of work requires a definite quantity of heat, and no more can be utilized in performing the work, but is wasted in one or more of the various ways enumerated. It is therefore perfectly logical to determine the amount of fuel needed for doing useful work, and if the engine is in poor condition or improperly treated, an allowance should be made in estimating the total coal consumption. What this should be it is generally impossible to state, as there is no way of accurately estimating the effect of such circumstances. As tests are made under ordinary working conditions, we can assume that the values so obtained will cover a number of the defects which generally have to be contended with, but leaks and other severe drains upon the boiler should certainly not be included.

All work performed is the product of force and speed, and so the work done by a locomotive is represented by the drawbar pull or the tractive force, and the speed at which this force is maintained. If now we can determine the quantity of fuel required for any and all combinations of speed and pull within the capacity of the engine, we can also, by knowing the resistance offered by grades, curves, etc., find out the amount of coal needed on such grades, etc., in order to take the train at the required speed. From a study of some tests made by the author a few years ago, it has been found possible to elaborate a diagram for any particular locomotive whose general dimensions are known, which will give at once the fuel consumption per mile or per hour, the diagram being based upon theoretical as well as practical considerations, and giving values, it is believed, agreeing closely with actual conditions.

The construction of the diagram and the method of using it can, perhaps, be made most clear, by assuming a locomotive of certain proportions, and developing the study for this engine. We will consider a consolidation locomotive or 2-8-0 type having the following general dimensions:

| | |
|---|---|
| Diameter of cylinders | 21 ins. |
| Stroke of pistons | 32 " |
| Diameter of drivers | 56 " |
| Boiler pressure | 200 lbs. |
| Grate area | 40 sq. ft. |
| Heating surface | 3,200 " |
| Weight of engine and tender | 150 tons |

The theoretical tractive force of such a locomotive will be

$$\text{T.T.F.} = \frac{P\ d^2\ s}{D} \quad \ldots\ldots\ldots\ldots (2)$$

where P = Boiler pressure in pounds per sq. in.
d = Diameter of cylinder in inches.
s = Stroke of piston in inches.
D = Diameter of drivers in inches.

When we allow for drop in steam pressure and internal resistance, we find that the available tractive force at circumference of the drivers is only .8 of the theoretical tractive force or

$$\text{A.T.F.} = \frac{.8\ P\ d^2\ s}{D} \quad \ldots\ldots\ldots (3)$$

for simple engines, when working at slow speeds with the reverse lever in the corner notch.

For the engine under consideration we therefore find as follows:

$$\text{T. T. F.} = \frac{200 \times 441 \times 32}{56} = 40{,}000 \text{ lbs. approx.}$$

As the speed of the locomotive increases, however, beyond the point where the boiler can supply the complete volume of the cylinders at each stroke, an earlier cut-off must be used and it is necessary to determine the effect of such a change. In order that this may occur at the maximum possible speed, the boiler must be worked to its full capacity, which is limited by its ability to burn fuel. From various tests it seems as if this limit might be considered as stated below, the quantities being expressed in pounds of coal per square foot of grate area per hour:

| | |
|---|---|
| Bituminous coal | 200 lbs. |
| Anthracite, large sizes | 100 " |
| Anthracite, small sizes | 60 " |

We will assume that our engine is burning Pennsylvania or Virginia semi-bituminous coal, therefore the maximum combustion will be 40 × 200 = 8,000 lbs. coal per hour. We admit that this is a large amount to be handled by one man for any great length of time, but there is no doubt that it could be burnt if supplied. In order to determine the quantity of steam generated by this amount of fuel in the boiler which we have assumed, Fig. 1 is introduced. This has been compiled from various sources of information, and it is thought fairly represents the average practice in this country. In this figure, the ordinates give the maximum evaporation in pounds of water from and at 212 deg. Fahr. per square foot of heating surface per hour that can be expected under ordinary conditions, as stated above, the abscissae denoting the ratio of heating surface to grate area. For the engine in question this will be

$$\frac{3{,}200}{40} = 80,$$

and for semi-bituminous coal, curve "C," we find that with a ratio of 80, fifteen pounds of water from and at 212 deg. may be evaporated per hour from each square foot of heating surface, or for the boiler as a whole,

3,200 × 15 = 48,000 lbs. per hour.

The factor of evaporation from ordinary temperatures of feed water will be about 1.2, so that we shall have at boiler pressure

$$\frac{48{,}000}{1.2} = 40{,}000 \text{ lbs. per hour.}$$

The steam will be somewhat reduced in pressure at the cut-off point, however, and the table here given indicates the probable relation of this pressure to the boiler pressure, when the reverse lever is in the corner notch, and the throttle wide open.

*Ratios of Cut-Off Pressure to Boiler Pressure.*

| Revolutions per min. | Starting. | 50. | 100. | 150. | 200. |
|---|---|---|---|---|---|
| Long ports | 0.98 | 0.94 | 0.88 | 0.83 | 0.78 |
| Short ports | .98 | .92 | .85 | .77 | .72 |
| Medium ports | .98 | .96 | .86 | .80 | .75 |

By long ports is meant those in which the length of port in inches divided by the area of the cylinder in square inches is approximately .12, and by short ports, where this ratio is about .05. If we assume .90 for the ratio in the case in hand, we shall have

200 × .90 = 180 lbs. at cut-off,

which steam will weigh .432 lb. per cubic foot. The volume of a cylinder 21 in. in diameter and 32 in. long is 6.4 cu. ft., or for one revolution four times this amount, or 25.6 cu. ft. No allowance is made for clearance, as the cut-off, with lever in the corner, is usually about 90 or 92 per cent. of stroke. For each revolution, then, the steam consumption will be

25.6 x .432 = 11.06 lbs.

and

$$\frac{40{,}000}{60 \times 11.06} = 60 \text{ revolutions per minute}$$

as the maximum speed at which the boiler will furnish steam at full stroke. The speeds in miles per hour corresponding to the revolutions per minute for a 56-in. wheel are as follows:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | miles per hour. |
| 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | revs. per min. |

Therefore it is plain at above 10 miles an hour the cut-off must be reduced, diminishing the available tractive force of the engine. A study of the variation in tractive force due to speed indicates that the method explained below gives a close approximation to actual results.

In Fig. 2 the ordinates represent the tractive force in pounds, and the abscissae the speed in miles per hour. As the maximum speed at full stroke was found to be 60 r.p.m., or 10 miles an hour, we find the intersection of this speed with the theoretical tractive force at "A." We therefore construct an equilateral hyperbola through this point, that is, a curve the product of whose ordinates will always have the same value, viz., 50,000 x 10 = 500,000. As we have seen, the available tractive force, however, cannot exceed 40,000 lbs. By drawing from the point "B" a tangent to the hyperbola, we then have a locus consisting of a straight line and a curve, and this locus gives us the maximum available tractive force (at circumference of the drivers) for which the boiler will supply the cylinders at any speed. But to do this, we must burn 8,000 lbs. of coal an hour, so that the locus BC also gives the combinations of speed and available tractive force which may be obtained by the combustion of 8,000 lbs. of coal an hour.

The rate of combustion per square foot of heating surface per hour is $\frac{8{,}000}{3{,}200} = 2.5$, and from Fig. 3 (curve C) we should expect 6 lbs. of water per pound of coal from and at 212 deg., or a total steam production of 8,000 x 6 = 48,000 lbs., which is the same as our first figure. If the rate of combustion be reduced, however, there will be more steam generated per pound of coal, as indicated by Fig. 3. For instance, if three-quarters the amount be consumed, or 6,000 lbs., the rate of combustion will be $\frac{6{,}000}{3{,}200} = 1.87$ lbs. per sq. ft. of heating surface, and from Fig. 3, the evaporation will be about 7 or 7 x 1.87 = 13.09 lbs. of water per sq. ft. of heating surface per hour, instead of 15 lbs. as before. This would supply the cylinders at full stroke for 15:13.09::10:8.7 miles an hour. From this, as a starting point, we construct a new hyperbola and tangent as before, which locus gives the combinations of speed and tractive force for 6,000 lbs. of coal an hour. In the figure the loci have been drawn for each thousand pounds per hour from 1,000 to 8,000.

If now we divide the quantities per hour by the speed, we obtain the fuel consumption per mile, and this is shown by the dotted lines. Thus with a tractive force of 20,000 lbs. and a speed of 15 miles an hour, we should expect an hourly consumption of 3,000 lbs., or 200 lbs. per mile. With a force

of 25,000 lbs., and a speed of 20 miles an hour, we should use 400 lbs. per mile, or 8,000 lbs. per hour, and as this is our limit of combustion if we wished more tractive force, we should be compelled to reduce the speed. For instance, if we needed 30,000 lbs., the speed would fall to 17 miles an hour, and at that velocity we should just be able to maintain the 200 lbs. pressure in the boiler. If we wished to increase our speed to 30 miles an hour, the train load would have to be reduced so that a tractive force of 17,000 only would be needed. The line BC therefore gives the limiting conditions of operation, and of course the 40,000-lb. tractive force line limits the pull below 10 miles an hour.

If the engine were burning fuel oil, our calculations would be somewhat different. As a grate is not used, but merely an oil injector, we must figure upon the heating surface only. It has been found possible to burn oil at the rate of nearly 1½ lbs. per sq. ft. of heating surface per hour, and to obtain an evaporation of 12 or 13 lbs. of water per pound of oil from and at 212 deg. It is probable that this rate can be exceeded, but just how much we do not know. This gives us 18 lbs. of water per sq. ft. of heating surface evaporated per hour from and at 212 deg., or a total steam generation of 3,200 x 18 = 57,600 lbs. Dividing by the factor of evaporation 1.2, we obtain 48,000 lbs. per hour, and also 48,000 ÷ (60 x 11.06) = 72 r.p.m., or 12 miles an hour for the maximum speed at which steam may follow full stroke. Fig. 4 has been constructed in a manner similar to Fig. 2, the product of the co-ordinates of the curve BC below the point of tangency equalling 50,000 x 12 = 600,000. The curves representing the consumption per mile and per hour are found as before explained, the maximum being assumed at 3,200 x 1½ = 4,800 lbs. per hour. The increase in speed for a given tractive force or vice versa, as compared with coal (Fig. 2) is quite interesting, and is well-known from practical observation, where oil burners are used in the same territory as coal burning locomotives.

For example, from Fig. 2 we found that with a tractive force of 25,000 lbs. the maximum speed that could be expected would be 20 miles an hour. In Fig. 4, however, with this tractive force, a speed of 24 miles an hour could be maintained, or at 20 miles an hour, a tractive force of 29,500 lbs. could be exerted. Again, with a pull of 30,000 lbs. we could attain a speed of 19½ miles an hour instead of 17, as before, and even better can sometimes be done, possibly by increasing the rate of oil fed and burned. The high rate of combustion and the great heat concentrated upon the firebox sheets in the immediate vicinity of the arch are very destructive, and boiler repairs are frequent and costly, but for transportation purposes oil is an ideal fuel—there are no ashes to be removed, if properly handled, smoke is unknown, except when sanding the flues, and the labor of placing the fuel upon the tender is extremely small. The weight to be carried is also much less, as will be seen from the diagram; when working at its maximum capacity, 4,800 lbs. of oil will do more work than 8,000 lbs. of coal. This is because at the high rate of combustion much of the coal is carried unburnt up the stack, whereas in oil burning, if the fireman be alert, there is practically no such loss. In the case of coal it cannot be prevented, but with oil, it is a question of careful manipulation of the supply valves. As the rate of combustion diminishes, the loss of coal becomes less. Thus with a tractive effort of 20,000 lbs. and a speed of 25 miles an hour, we would burn (or use) 8,000 lbs. of coal and only 4,000 lbs. of oil, or one-half as much. At 15 miles an hour, however, and the same tractive force we would use 3,000 lbs. of coal and 2,400 lbs. of oil an hour, four-fifths as much, due to the greater evaporative efficiency of coal at low rates of combustion than at high rates.

Suppose now that we compound our oil burner, and instead of simple cylinders 21 in. x 32 in., we use two high-pressure 18 in. x 32 in., and two low-pressure cylinders 26 in. x 32 in. The volume of one high-pressure cylinder will be 4.7 cu. ft., or 18.8 for one complete revolution of four strokes. Multiplying as before, by the density, we obtain 18.8 × .432 = 8.12 lbs. per revolution, and with 48,000 lbs. of steam generated per hour we shall have 48,000 ÷ (60 × 8.12) = 98 r.p.m., say 16 miles per hour. The fuel consumption curves for this case are shown in Fig. 5, and we notice about 33 per cent. increase in the work per unit of fuel. This, of course, considers the engine maintained in good condition, and doing positive work; if running down hill, there will be no saving—sometimes a waste, as already explained. In any event, if the throttle be closed for half the time, then we could not expect as great economy for the whole distance, as the consumption down hill (for radiation, braking, etc.), will be equal to, if not greater, than in the simple engine.

The lines showing the pounds of fuel oil used per mile are straight, as we do not have the cinder losses under high rates of combustion. But we may go further and introduce superheating in connection with our compound oil burner. This, with the same amount of "water" heating surface, will cause an increase in volume of steam supplied to the cylinders at the same pressure, and in proportions as indicated in the following table, depending upon the temperature at which the steam reaches the cylinders.

*Ratio of Volumes of Superheated to Saturated Steam with Equal Fuel Consumptions.*

| Pressures... | 175 lbs. | 200 lbs. | 225 lbs. |
|---|---|---|---|
| Temperature. | Ratio of Volumes. | | |
| 400 | 1.02 | 1.01 | 1.00 |
| 450 | 1.06 | 1.04 | 1.03 |
| 500 | 1.10 | 1.08 | 1.06 |
| 550 | 1.13 | 1.11 | 1.10 |
| 600 | 1.16 | 1.14 | 1.14 |
| 650 | 1.19 | 1.18 | 1.17 |
| 700 | 1.22 | 1.21 | 1.20 |
| 750 | 1.25 | 1.24 | 1.23 |
| 800 | 1.28 | 1.27 | 1.26 |

If we obtain 200-lb. steam at 760 deg. Fahr. we shall have an increase of 25 per cent., and instead of 16 miles an hour we can run 20 = 16 × 1.25 before exceeding the capacity of the boiler. Of course this all depends upon actually being able to heat the steam to this temperature, and not merely upon the fact that a superheater has been placed on the engine. Fig. 6 gives a set of curves for this combination, and it is seen that the output of the locomotive has apparently been doubled, when compared with the simple coal burner. Thus we find that the maximum speeds for various tractive forces stand as below:

| Tractive force, lbs. | Maximum speed, per hr. Simple coal | Comp. super. oil. |
|---|---|---|
| 40,000 | 10 miles. | 20 miles. |
| 35,000 | 13 " | 26 " |
| 30,000 | 17 " | 32½ " |
| 25,000 | 20 " | 40 " |

Comparing the weight of fuel used for similar speeds and pulls, we see a great difference also. Thus, for 40,000 lbs. tractive force, at 10 miles an hour, we should use 800 lbs. of coal per mile, but only about 250 lbs. of oil. However, at the same speed and with a pull of 12,000 lbs., the quantities would be 100 lbs. of coal and about 55 lbs. of oil per mile. It must be remembered that these conditions are exceptional, yet they are no doubt possible, if the compound and superheating features are well designed and maintained. These points are of great interest, but they are merely preliminary to computing the consumption of fuel under different physical and operating conditions. It is necessary, however, to first obtain a clear conception of the construction and meaning of the curves, and for this reason we have gone into the matter at some length.

The tractive force enables the locomotive to overcome the resistance of trains, and it is necessary to determine the resistance or resistances due to the conditions which have to be met, such as speed, grade, curvature, acceleration and loading, as well as weather and temperature variations. The formula which we prefer for "speed resistance" is that advanced by the *Engineering News* some years ago, and which is

$$R = 2 + \frac{V}{4} \quad \ldots\ldots\ldots\ldots (4)$$

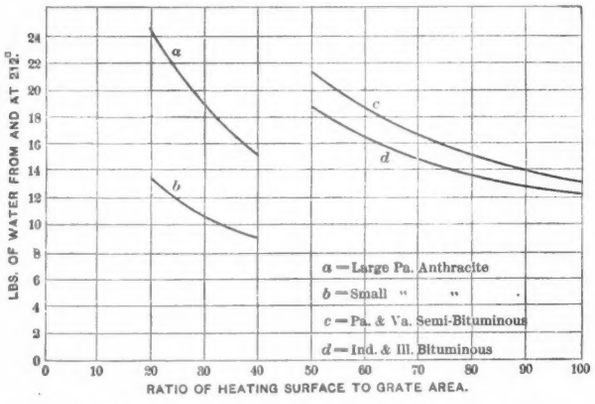

LBS. OF WATER FROM AND AT 212°
RATIO OF HEATING SURFACE TO GRATE AREA.
a = Large Pa. Anthracite
b = Small " " "
c = Pa. & Va. Semi-Bituminous
d = Ind. & Ill. Bituminous

Fig. 1—Maximum Evaporation Per Square Foot of Heating Surface Per Hour.

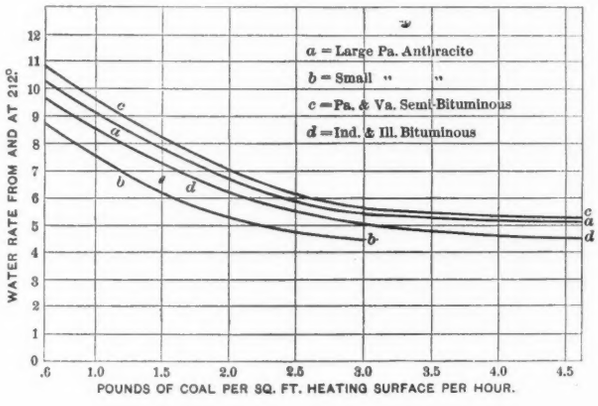

WATER RATE FROM AND AT 212°
POUNDS OF COAL PER SQ. FT. HEATING SURFACE PER HOUR.
a = Large Pa. Anthracite
b = Small " "
c = Pa. & Va. Semi-Bituminous
d = Ind. & Ill. Bituminous

Fig. 3—Evaporative Value of Coals.

where R = resistance in pounds per ton (2,000 lbs.).

V = Velocity in miles per hour.

Below 12 miles an hour, formula (4) gives values that are generally too low, and therefore it is not applicable below that speed. At starting, the resistances are usually great, and are often taken at about 16 lbs. per ton. It is probable that at low speeds the resistance is about as follows:

| Speed, miles, per hour. | Resistance in lbs. per ton. | Speed, miles, per hour. | Resistance in lbs. per ton. |
|---|---|---|---|
| 0..... | 16 | 6..... | 5 |
| 1..... | 11 | 7..... | 5⅛ |
| 2..... | 8 | 8..... | 5¼ |
| 3..... | 6½ | 9..... | 5⅜ |
| 4..... | 5½ | 10..... | 5½ |
| 5..... | 5 | | |

However, the make-up of the train enters very largely into the proposition, and equation (4) takes no cognizance of such variations. It is well-known that empty trains pull harder, for equal weights, than loaded trains, and we must allow for this circumstance. We can do this by using a formula that takes into account both the weight of the train and the number of cars. Thus if we let

T = weight of train in tons (of 2,000 lbs.);

C = number of cars in train;

$f$ = a coefficient depending upon the speed, and which may be taken equal to $3.5 + \frac{V - 12}{4}$, for speeds over 12 miles an hour;

we can express the total resistance of the train in pounds, on a level tangent, and at the tender drawbar as equal to

$$f\,T + 50\,C \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

The values of $f$ given below may be inserted in the formula:

| Speed = $V$ ... | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 |
|---|---|---|---|---|---|---|---|---|
| Coef. = $f$ ... | 3.00 | 3.50 | 4.25 | 5.50 | 6.75 | 8.00 | 9.25 | 10.50 |

When we study these values in connection with fuel consumption we will discover the effects of loading upon coal economy.

The effect of a grade is to increase the resistance by an absolute amount, regardless of speed or loading, and this amount depends only upon the weight of train and the rate of gradient. If we let

M = rise in feet per mile;

N = per cent. of grade, we have

$$R = .38\ M = 20\ N \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

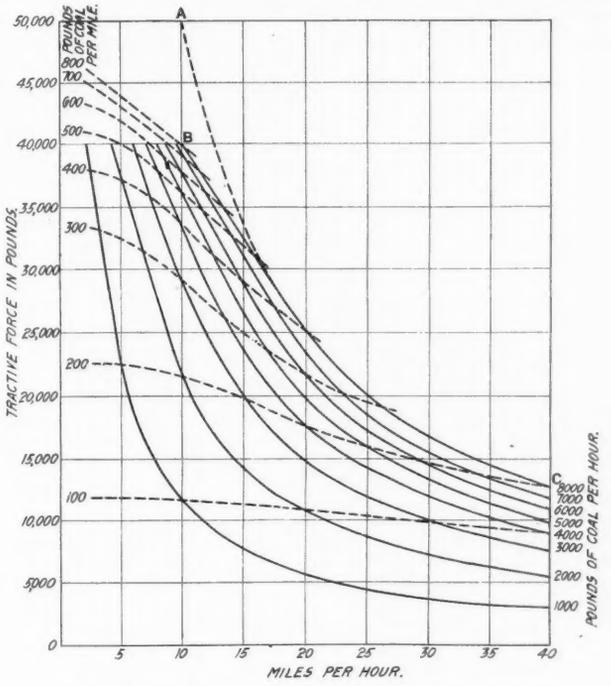



Fig. 2—Coal Consumption of a Simple Locomotive.

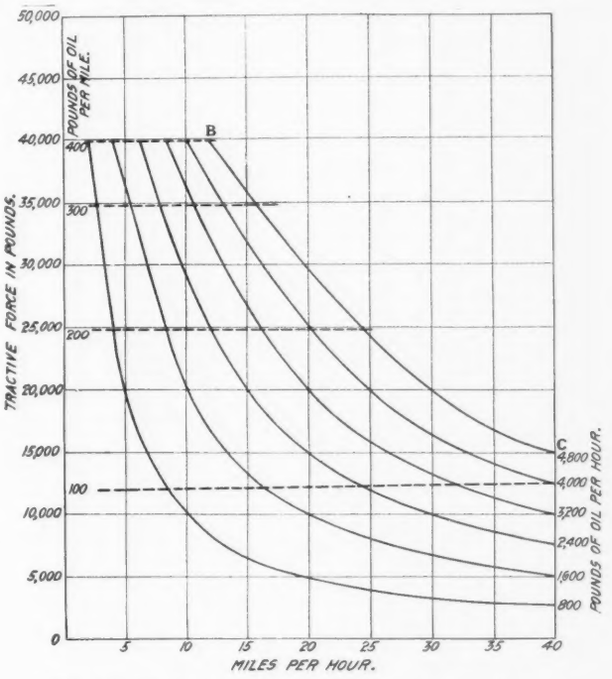



Fig. 4—Oil Consumption of a Simple Locomotive.

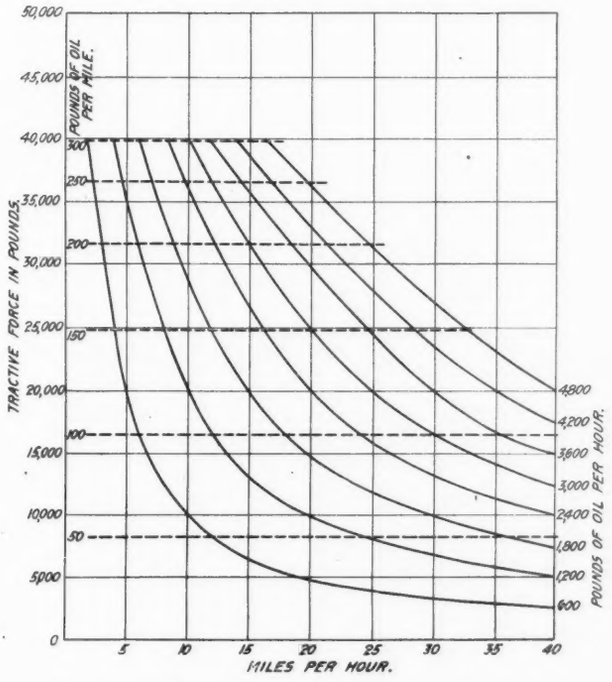



Fig. 5—Oil Consumption of a Compound Locomotive.

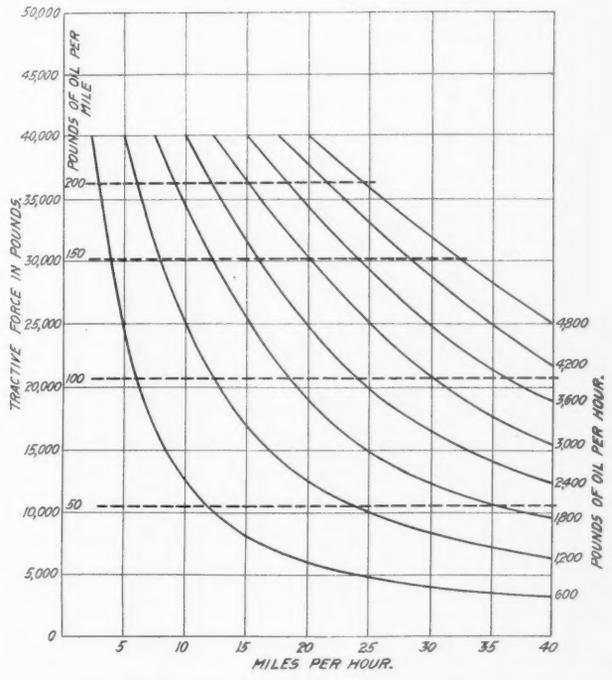



Fig. 6—Oil Consumption of Compound Locomotive with Superheater.

R, as before, being the resistance in pounds per ton.

On curves, we may take the resistance as .7 lb. per ton per degree of curvature for cars and 1.4 lbs. for locomotives, this to be added to the other resistances, or

R = .7 C (for cars) and 1.4 C for (locos.). (7)

where C = curvature in degrees.

When a train (or any body) has its velocity increased, or accelerated, the inertia of the body comes into play. We can discuss this by considering a time or distance effect. Thus if we let

S = distance in feet in which acceleration takes place

t = time during which acceleration is present, in seconds.

V = velocity in miles per hour produced by the above acceleration from a state of rest, we have

$$R = 70\,\frac{V^2}{S} = 95.6\,\frac{V}{t} \quad \ldots\ldots\ldots (8)$$

R being the resistance or force needed in pounds per ton as previously. These equations take into account the revolving energy or inertia of the wheels and axles. If an increase in velocity from $V_1$ to $V_2$ must be considered, we simply write

$$R = 70\,\frac{V_2^2 - V_1^2}{S} = 95.6\,\frac{V_2 - V_1}{t} \quad \ldots (9)$$

In equations (8) and (9) R is the average force or resistance during acceleration —some portions of the time it may be greater and some less than R.

Weather and temperature exert a considerable influence upon the coal pile, as will be recognized that it is customary to reduce loads under such stress, which means that the load is that much smaller for the same coal consumption, or the same pull on the drawbar. For temperature variations, a number of roads that experience very cold winters, make a reduction in the train load of from one-half to three-quarters of 1 per cent. per degree Fahr. below 40 deg.; others arbitrarily reduce ratings 10 or 15 per cent. during the winter months.

In stormy weather, and on the western prairies during heavy winds, the train resistance is so much increased that it is necessary to reduce loads in order to get over the road, this amounting often from 10 to 20 per cent., so that the influence of climate is quite severe upon the fuel bills.

Let us now apply these several formulæ to fuel consumption and find out how the quantity used is affected by them. Fig. 7 shows the resistance in pounds of the engine and tender, and also several weights of trains at various speeds. The abscissae are speeds given in miles per hour and the ordinates the resistance of the train in pounds, and correspond to the tractive force of Figs. 2, 4, 5 and 6. The diagram is printed on thin paper, so that it can be superimposed on any of the tractive force or fuel consumption diagrams, and the two read together. The lowest curve represents the resistance of the engine and tender at different speeds and was constructed by passing a line through points found by multiplying the weight (150 tons) by the value given above for speed resistance, thus at five miles an hour, 150 x 5 = 750 lbs., and at 20 miles $150 \times \left(2 + \frac{V}{4}\right) = 150 \times 7 = 1{,}050$. The trains of 1,000 to 2,000 tons back of tender are constructed in the same manner, the weight of engine and tender being added: thus for 1,000 tons net at five miles an hour we have $(1{,}000 + 150) \times 5 = 1{,}150 \times 5 = 5{,}750$ lbs., and for 2,000 tons, $2{,}150 \times 5 = 10{,}750$ lbs. On a 1 per cent. grade, for 1,000 tons, we add the resistance found by formula 6, thus $1{,}150 \times (5 + 20) = 1{,}150 \times 25 = 28{,}750$ lbs., or $1{,}150 \times 20 = 23{,}000$ lbs. more than on the level. This process is followed through for the different speeds and a curve drawn which is 23,000 lbs. greater at every point than the one for 1,000 tons on the level, the effect of gravity, due to the grade, being a constant quantity, and entirely independent of the speed or other factors, as demonstrated by formula 6. The curves for a 1 per cent. grade are shown on Fig. 8.

*Speed.*—In order now to determine the effect of speed upon coal consumption, let us combine Figs. 2 and 7, which will give us the results for a simple coal burner. Laying the thin sheet (Fig. 7) over Fig. 2 so that the border lines correspond, we can read off directly the fuel consumption under the different conditions which we have assumed. If we consider a train of 2,000 tons back of tender, on a level, we find that our coal consumption per mile will be approximately as follows:

| Speed, miles per hour | 5 | 10 | 15 | 20 | 25 |
|---|---|---|---|---|---|
| Pounds coal per mile | 90 | 100 | 125 | 170 | 250 |

These results are obtained by noting the distance between the dotted lines on Fig. 2, where the 2,000-ton line crosses the lines corresponding to the speeds given, interpolating to establish the pounds of coal per mile. At 10 miles per hour it crosses the 100-lb. per mile line, and the 200-lb. line at about 22½ miles. If we divide these amounts of coal by the weight of train (exclusive of engine and tender) we obtain the quantity per ton-mile, generally given in "pounds of coal per 100 ton-miles," in which case we must divide by 20 as 20 × 100 = 2,000.

| Speed in miles per hour | 5 | 10 | 15 | 20 | 25 |
|---|---|---|---|---|---|
| Pounds coal per 100 ton-miles | 4.5 | 5.0 | 6.3 | 8.5 | 12.5 |

This gives us at once an idea of the way in which speed affects the coal pile, although in each case the weight of train is the same, and of course the ton-miles hauled are identical, the only thing gained being the quicker movement. At 25 miles an hour we find that the coal used per ton-mile will be more than double what it is at 10 miles an hour.

If we consider 1,000 tons on a 1 per cent. grade, we take the intersections of diagrams 2 and 8 on the line so marked. Thus we find as follows:

| Speed in miles per hour | 5 | 10 | 15 | 17 |
|---|---|---|---|---|
| Pounds of coal per mile | 260 | 300 | 430 | 490 |
| Pounds coal per 100 ton-miles | 26 | 30 | 43 | 49 |

While these amounts are very much larger than on the level (it is only what might be expected) the rate of increase due to variation in speed is about the same. If we wish to determine similar values for a simple oil burning locomotive, we lay Fig. 8 over Fig. 4, and find for the 1,000-ton train on 1 per cent. grade:

| Speed in miles per hour | 5 | 10 | 15 | 19 |
|---|---|---|---|---|
| Pounds of oil per mile | 240 | 243 | 250 | 260 |
| Pounds oil per 100 ton-miles | 24 | 24.3 | 25 | 26 |

Here the increase is not as great, due largely to the fact that we do not have the same cinder losses as with coal when the engine is forced.

These problems show us the great increase in fuel bills that may be expected if the speed of trains is increased, if lost time be made up frequently, or a higher class of trains be run requiring quicker movement, the monthly statement is bound to reflect it. A question often asked by managers is "why more fuel was burnt per ton-mile last month than the previous one." If more time has been made up by delayed trains, or a larger proportion of stock runs sent out, there will certainly be an increase in the amount of fuel consumed, and in order to answer such questions intelligently, all the facts must be at hand. This is sometimes difficult for the motive power department, as these records are kept by the transportation department. Of course, there are other causes which may also affect the coal rate, as we have already shown, but considering these to be without change, a variation in the speed will produce great disturbances. At the January, 1900, meeting of the Western Railway Club, Mr. F. H. Clark (Supt. M. P., C., B. & Q. R. R.) demonstrated by results obtained in actual practice that it required nearly twice as much coal *per car* to haul a passenger train of four cars at 48 miles per hour as to haul one of seven cars at 31 miles per hour. This takes into consideration the diminution of the train in order to allow the locomotive to make the necessary speed. If we again place together Figs. 2 and 7, we find that it will require 200 lbs. of coal per mile to haul 2,000 tons on a level at 22½ miles per hour, or the same amount to move 1,000 tons at 37½ miles an hour; in the first case, the amount per 100 ton-miles would be $\frac{200}{20} = 10$ lbs., and in the second $\frac{200}{10} = 20$ lbs. If, however, we should move 1,000 tons only at 22½ miles per hour, we would have a consumption of 80 lbs. per mile, or 8 lbs. per 100 ton-miles. It will be evident that the combination of such diagrams permits the solving of a great variety of questions, not only concerning the speed variation of trains, but when also interwoven with trains of different sizes.

*Weight of Train.*—The same diagrams (Figs. 2, 7 and 8) will also enable us to solve problems connected with variations in weight of train, back of tender. The set of curves in Fig. 7 shows the resistance of trains from 1,000 to 2,000 tons in weight, on a level. This does not consider variations in methods of loading, which will be taken up later. At 10 miles an hour we find that the 1,000-ton curve crosses the 10-mile line at about what would correspond to 50 lbs. of coal per mile, or 5 lbs. per 100 ton-miles. If the load be increased to 2,000 tons, the consumption per mile will reach 100 lbs., or divided by 20, we also have 5 lbs. per 100 ton-miles. As the intermediate divisions for 1,100, 1,200 tons, etc., are uniform, it is apparent that a variation of train load at 10 miles an hour, between the limits stated, will have little effect upon the coal used per unit of movement. If, however, we run at 25 miles an hour, we find for 1,000 tons 90 lbs. per mile, or 9 lbs. per ton-mile, and for 2,000 tons 250 lbs. per mile, or 12.5 lbs. per ton-mile. Here is a decided increase in the amount of coal per unit of work done, caused by increasing the weight of train until we approach the limit of the engine's power, on account of the more rapid rate of combustion needed and the corresponding spark losses. At 1,500 tons we have 10¾ lbs. per 100 ton-miles, so that there is a gradual increase for every 100 tons that we add to the weight of the train.

Let us see now what is the effect on a 1 per cent. grade, shown by the curves of Fig. 8. At 10 miles an hour, 1,000 tons will require 300 lbs. of coal per mile, or 30 lbs. per 100 ton-miles; 1,200 tons, 425 lbs. per mile, or 35 lbs. per 100 ton-miles, and 1,400 tons, 700 lbs. per mile, or 50 lbs. per 100 ton-miles. Here the increase is very rapid. Again, if we consider a speed of five miles per hour, we obtain for the 1 per cent. grade 26, 27 and 32 lbs. per 100 ton-miles with trains of 1,000, 1,200 and 1,400 tons respectively. Returning now to the curves on Fig. 7, and at five miles an hour on the level, we have for 1,000, 1,500 and 2,000-ton trains 5, 4⅜ and 4½ lbs. per 100 ton-miles respectively, a *decrease* in the rate of fuel consumption as the load is *increased*. This is due, no doubt, to the dead weight of the engine and tender being distributed over a larger train load, or the weight of engine and tender is a smaller proportion of the total train weight.

These points are very important. It is frequently claimed that heavy trains use less coal per ton-mile than light ones, with the same engine. This is not always true, as

has just been demonstrated. There may be so much level track over the division that the benefits of the increased loads, at slow speeds, may be more than sufficient to overcome the expensive effects of grades. However, as a general proposition we may consider that when we approach nearly to the maximum limit of power of the locomotive, the increase in fuel consumption for increasing loads will be large. This is especially so when the full tractive force is being developed. At 10 miles an hour, 1,400 tons may be taken up a 1 per cent. grade with an expenditure of 700 lbs. of coal per mile, or 50 lbs. per 100 ton-miles. If, however, we take 1,430 tons at the same speed, we find that it will require 800 lbs. per mile, or 56 lbs. per 100 ton-miles.

*Weight and Speed.*—Perhaps the most interesting and important results are obtained when we combine the effects of weight of train and speed together. As is shown by Fig. 2 and the other similar diagrams, when the speed increases beyond a certain point (10 miles an hour in Fig. 2) the tractive force decreases, which means that a lighter train must be taken. Let us now see the effect of speed, when we consider that the engine is in all cases loaded to its full steaming capacity. This can be determined by following along the 40,000-lb. tractive force (or resistance) line to the point B, and then down the curve from B to C. By again superimposing Fig. 8 we obtain the combination of train weights and speeds, on a 1 per cent. grade, and fuel consumption. Proceeding as before, we can tabulate the speed, train load back of tender, coal used per mile and per 100 ton-miles as follows:

| Speed in miles pr hour | 5 | 7½ | 10 | 12½ | 15 | 17 |
|---|---|---|---|---|---|---|
| Weight of train, back of tndr. | 1,450 | 1,445 | 1,430 | 1,280 | 1,100 | 1,000 |
| Pounds of coal: | | | | | | |
| Per mile | 500 | 630 | 800 | 650 | 540 | 490 |
| Per 100 tn-mls. | 35 | 44 | 56 | 51 | 49 | 49 |

As we increase the speed further the amount of coal per 100 ton-miles also increases. Thus at 20 miles an hour, a train load of 800 tons would use 50 lbs., and at 25 miles an hour 600 tons would require 53 lbs. per 100 ton-miles.

When we examine loads and speeds for a level with Fig. 7, we find as below:

| Speed in miles per hour | 27 | 30 | 35 | 40 |
|---|---|---|---|---|
| W't. train, back of tender | 2,000 | 1,600 | 1,200 | 900 |
| Pounds of coal per mile | 300 | 260 | 230 | 200 |
| " coal per 100 ton-miles | 15 | 16 | 19 | 21 |

These figures show a gradual increase with higher speeds. If we compare these with the changes made in speed only we see that if we reduce speed and maintain the same train load, we will ordinarily burn less coal per ton-mile than if we accompany the drop in speed by an increase in load in accordance with the power of the engine. Thus if we consider a train of 1,000 tons on a 1 per cent. grade, which can make with the engine under consideration 17 miles an hour, with a fuel consumption of 49 lbs. per 100 ton-miles. If we keep the same load and reduce speed to 10 miles an hour, the fuel will run 30 lbs., but if we accompany the drop in speed by an increase in load to 1,430 tons (which we can do and still not exceed the power of the engine) it will require 56 lbs. of coal per 100 ton-miles.

These demonstrations make clear the fact that to operate a freight or any train economically, from a fuel standpoint, all the schedule time should be utilized between stations; in other words, use as much time running, and as little stopping as possible, to adhere to the schedule. Of course, when necessary, time that is lost must be made up, regardless of the coal bills, but as a general proposition the above rule obtains.

*Grade.*—In order to study the effects of a variation in grade, Fig. 9 has been prepared. The heavy lines give the resistance for 1,000 tons (in 20 cars) back of tender, and for grades from level up to 1½ per cent. The resistance is calculated by formulae 4 and 5. Thus for a speed of five miles an hour we have

| | | | |
|---|---|---|---|
| For train, f. T. | = | 3x1,000 | = 3,000 lbs. |
| For train, 50 C. | = | 50x20 | = 1,000 " |
| Engine and tender | = | 150x5 | = 750 " |
| Total resistance | | | = 4,750 lbs. |

This gives us the point on the five-mile-an-hour line. If on a ¼ per cent. grade, we simply add (1,000 + 150) × 5 = 5,750, in accordance with equation 6, making 5,750 + 4,750 = 10,500 lbs. The remaining lines are constructed in a similar manner. By laying this diagram over Fig. 2, we can obtain the coal consumption, as before. Taking the speed of five miles an hour, which is about as slow as should be figured upon, we find the coal used will be as follows:

| Grade in per cent. | 0 | ¼ | ½ | ¾ | 1 | 1¼ | 1½ |
|---|---|---|---|---|---|---|---|
| Lbs. coal per mile | 40 | 85 | 140 | 195 | 250 | 325 | 475 |
| Lbs. per 100 ton-mls. | 4 | 8.5 | 14 | 19.5 | 25 | 32.5 | 47.5 |

If we increase the speed to 15 miles an hour, we obtain different values thus:

| Grade in per cent. | 0 | ¼ | ½ | ¾ | 1 |
|---|---|---|---|---|---|
| Coal per mile | 55 | 110 | 175 | 275 | 425 |
| Coal per 100 ton-miles | 5.5 | 11 | 17.5 | 27.5 | 42.5 |

It will be seen at once that the grade has a very great effect upon coal bills, and that a hilly road cannot be expected to make as good a showing as a level one. It might be thought that the down-hill portions would make up for the ascents, by using no steam on this part of the trip. Let us consider two stretches of road: one level and the other ½ per cent. up for half the distance and down the same amount for the remainder, averaging a level. In the second case, if we admit that no coal will be used running down the grades (which will never be strictly true) the average for the whole distance will be one-half of that shown above, or 7 lbs. per 100 ton-miles at five miles an hour, and 8.75 at 15 miles. On a level the consumption would run 4 and 5.5 lbs. respectively, very much less than with the summit, but having an *average level.*

When studied in connection with speed, we obtain different results, as might be expected. When fast freights are on the road they generally run as rapidly up grade as the boiler will supply steam to the cylinders. From Figs. 2 and 9 we see at once the maximum speed which the engine in question will make with 1,000 tons on various grades, by noting the points where the different curves cross the line B.C. The coal consumption is also taken directly and this, divided by 10, gives the quantity per 100 ton-miles.

| Per cent of grade | 0 | ¼ | ½ | ¾ | 1 | 1¼ | 1½ |
|---|---|---|---|---|---|---|---|
| Speed, miles per hr. | 39 | 31 | 24 | 20 | 17 | 13 | 10 |
| Coal used per mile | 210 | 250 | 325 | 400 | 475 | 600 | 800 |
| Per 100 ton-miles | 21.0 | 25.0 | 32.5 | 40.0 | 47.5 | 60.0 | 80.0 |

At five miles an hour on the 1½ per cent. grade there would be 475 lbs. of coal used per mile, and 47.5 lbs. per 100 ton-miles. This table does not show as much variation as the one in which the speed was constant, as the higher velocity on the lower grades adds considerably to the amount of coal used. In estimating the quantity of coal that will be needed to take a train over a given division, each change of grade, when of any considerable length, must be figured separately, and the closer these sections are taken, the more reliable will be the results. Of course, what has been heretofore said about waste, condition of engine and quality of coal must all be taken into consideration, as we have shown that they have great influence upon the question.

*Curvature.*—In constructing the lines for resistance due to curvature, we are guided by equation 7, in addition to that due to speed. For a 1,000-ton train and 150-ton engine and tender we have, on a 5-deg. curve:

| | |
|---|---|
| 1,000x5x0.7 = | 3,500 lbs. |
| 150x5x1.4 = | 1,050 " |
| Total for curvature | 4,550 lbs. |

We simply add this amount to our "1,000 tons on level" line throughout its length, producing the locus marked "5 deg. curvature." For 10 deg., or another amount, we proceed in the same manner.

Taken in connection with changes in speed the curvature produces different rates of coal consumption. Thus at five miles an hour, a 10-deg. curve on a level would add to the 1,000-ton train an extra amount of coal of $\frac{120}{10} - \frac{40}{10} = 12 - 4 = 8$ lbs. per 100 ton-miles. At 25 miles an hour the extra rate would be $\frac{260}{10} - \frac{80}{10} = 26 - 8 = 18$ lbs. per 100 ton-miles. Continuous curves, however, rarely exist for any great distance. Many lines have reverse curves throughout the greater part of some divisions. In such cases, an estimate must be made of the relative resistance of the total curvature as compared with straight track. When grades are equated for curvature, it is sufficient to use the grade resistance, without reducing it where it is flattened for the curves. That curvature adds considerably to the coal bill there can be no doubt; engines have been stalled on level track by curvature alone, when the train was of great length, and this forcibly demonstrates the extra power required. For lines that are approximately straight, with a few curves of large radius, the consideration of increased fuel consumption may be omitted, but for those that are very crooked it should be taken into account.

*Loading.*—As the subject of "Adjusted Tonnage Rating" is now so prominent, we must consider its effects upon the coal pile, or rather upon the amount of coal burned per 100 ton-miles. If the number of tons back of tender remains the same, but the number of cars comprising this load be increased or diminished, the resistance of the train will likewise be increased or diminished, requiring greater or less quantities of coal for its movement; but as the weight of the train is constant, the result will be a variation in the fuel rate per ton-mile.

On Fig. 10 there are two sets of curves giving the resistance at different speeds of 1,000 tons (back of engine) and the engine and tender, on a level and also on a 1 per cent. grade, but with the load distributed in 20, 30, 40, 50 and 60 cars. These were calculated by means of formula 4 for the engine and tender and 5 for the train, as illustrated herewith.

| | Load, 1,000 Tons in 20 Cars | | | |
|---|---|---|---|---|
| | At 5 miles | | At 25 miles | |
| | Pounds. | | Pounds | |
| Train fT .. | 3x1,000 | = 3,000 | 6.75x1,000 | = 6,750 |
| Train, 50 C.. | 50x20 | = 1,000 | 50x20 | = 1,000 |
| Eng. & tndr. | 150x5 | = 750 | 150x8.25 | = 1,237 |
| Total resistance | | 4,750 | | 8,987 |

| | Load, 1,000 Tons in 60 Cars | | | |
|---|---|---|---|---|
| | At 5 miles | | At 25 miles | |
| | Pounds. | | Pounds | |
| Train fT .. | 3x1,000 | = 3,000 | 6.75x1,000 | = 6,750 |
| Train, 50 C., | 50x60 | = 3,000 | 50x60 | = 3,000 |
| Eng. & tndr. | 150x5 | = 750 | 150x8.25 | = 1,237 |
| Total resistance | | 6,750 | | 10,987 |

Now let us consider the 1,000-ton train on a level at 30 miles an hour, and see how the number of cars will affect the fuel rate.

| No. of cars | 20 | 30 | 40 | 50 | 60 |
|---|---|---|---|---|---|
| Coal per mile | 210 | 220 | 230 | 240 | 250 |
| Coal per 100 ton-miles | 21 | 22 | 23 | 24 | 25 |

At 15 miles an hour on a 1 per cent. grade we have:

| No. of cars | 20 | 30 | 40 | 50 | 60 |
|---|---|---|---|---|---|
| Coal per mile | 420 | 435 | 450 | 465 | 480 |
| Coal per 100 ton-miles | 42.0 | 43.5 | 45.0 | 46.5 | 48.0 |

We see from this at once that while the adjusted tonnage method enables us to equalize drawbar pull, and to compare ratings between different engines, it does not allow us to make comparisons between the fuel consumption of different engines and trains, unless we allow the tonnage *actually taken* to be represented by a *virtual tonnage*, which would give a definite drawbar pull. Engines that haul trains of large num-

bers of cars will always show a greater coal consumption per ton-mile than those which handle the same or greater tonnage in fewer cars, but the enginemen should receive no censure on *this account*, as the work is greater, and the train pulls harder and more coal per ton hauled will be burned. It is well for this to be thoroughly understood in this day of strict comparisons and critical examinations of operating costs.

*(To be continued.)*

### U. S. Steamboat Inspection.

From the *Evening Post*, New York.

One sweeping reform of vital import has been effected this winter. The agitation which this journal began in February, 1903, for a reorganization of the steamboat inspection service and a general overhauling of the antiquated statutes has borne fruit. Unhappily, the necessity for a change needed the terrible accentuation of the Slocum disaster to awaken the public conscience and bestir into action officers of the Government. All of the inefficiency charged by the *Evening Post* as existing in New York harbor was proved.

Congress has passed five of eight bills proposed for the improvement of the laws. Section 4,405, Revised Statutes, is amended by establishing an executive committee of the Board of Supervising Inspectors, with power to amend the rules of the service, subject to approval, in the interim between the meetings of the full board. The cost of convening a single session is very considerable and delay is great.

Under section 4,414, R. S., the salaries paid inspectors will be permanent and fixed, instead of *pro rata*. Heretofore vessels were sent to be inspected where inspection was most lax, and a premium was thereby placed on inferior and improper work. Inspection at least once a year will be compulsory. Under the old law there was no assurance that condemned and worthless life preservers, for instance, would not be kept in use. The inspectors now have power to enforce the repair, removal, or destruction of defective equipment by stopping the operation of the vessel until their orders are complied with. The statute now explicitly authorizes local inspectors to determine the number of licensed officers and crew to be carried on a passenger vessel. Ship owners are allowed an appeal to the department. . . . An amendment to section 4,416 adds assistant inspectors to those who are prohibited from having any pecuniary interest in vessels or patented articles.

The rule relating to boats, rafts, bulkheads, and life-saving appliances is amplified and made more stringent. Metal air tanks are required in lifeboats. A slight increase of boat capacity is demanded on river passenger steamers. The use of loose granulated cork and kapok in life preservers and life rafts is prohibited after May 1 next. The method of stowing or suspending life preservers is left to the discretion of the local inspector, subject to the general provision as to ready accessibility and distribution.

All passenger steamers must be provided with fire-buckets, barrels, and axes. Lamp-lockers, oil rooms, and like compartments must be provided with steam fire-branches and lined with metal. All hose connections after the end of the present month must be of United States standard pipe thread. Portable fire extinguishers are required to be installed on all passenger steamers; the number being fixed according to tonnage. Fire hose must be tested by inspectors to a pressure of 100 lbs. per sq. in., and one length of such hose must be kept attached to each outlet of the fire main. There must be fire mains on all decks, with a sufficient number of outlets so arranged that any part of the vessel can be reached by means of a single length of hose from at least one outlet.

Ferryboats are required to carry a larger number of lifeboats and to be supplied with a sufficient number of water-tight bulkheads to keep afloat if the largest compartment is filled with water. In place of the vague old requirement, it is now demanded that all ferryboats shall be equipped with a life preserver for every seven square feet of passenger-deck surface on single-deck boats and for every 12 sq. ft. on boats having more than one deck. They are also required to carry the same fire apparatus demanded on passenger steamers of equal tonnage.

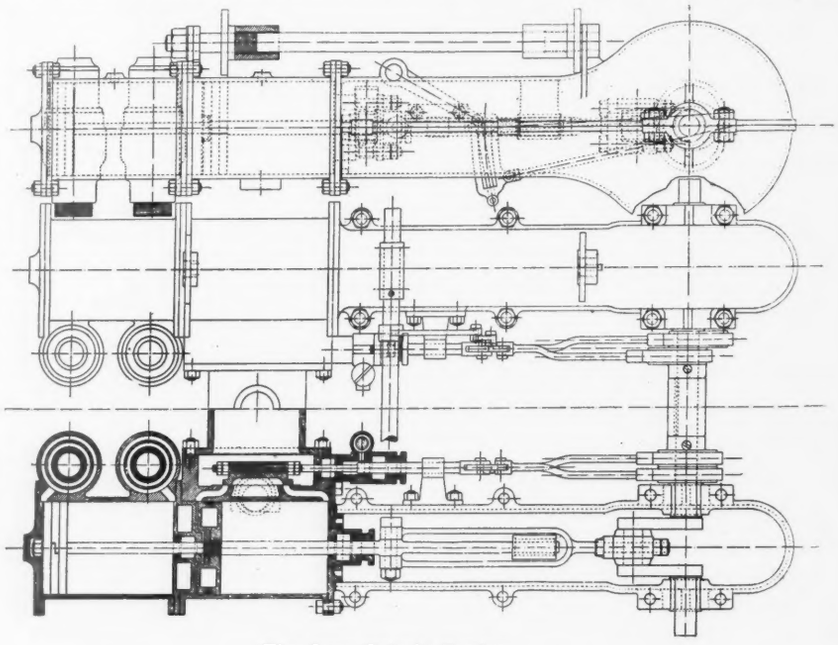
All barges carrying passengers are required to have a master and not less than two deckhands for every 500 passengers; also a life preserver for each passenger.

### A New External Combustion Engine.

When the limitations to the possible efficiency of the steam engine came to be fully understood something over 50 years ago, many engineers turned their attention to perfecting other forms of heat engines, and the first successful attempt was Ericsson's external combustion, hot-air engine, invented in 1850. It was soon found, however, that the method of heating the air employed by Ericsson was too slow for use in anything but very small units. The warm layers of air next to the heated walls of the cylinder simply rise into the stationary cool air above and gradually heat it up to a temperature of from 300 deg. to 400 deg. Cent., causing it to expand and move the piston. This process naturally requires considerable time and a large piston area for small power.

Ten years later when Lenoir devised a rapid way of accomplishing the same results by exploding a mixture of air and gas inside the cylinder the external combustion engine dropped into the background. The gas engine, however, has several inherent disadvantages which have not been overcome even in the most highly perfected type, and for this reason, although it has a thermal efficiency of 20 per cent. as compared with 14 per cent. for the steam engine, it has not yet altogether displaced the steam engine. It is neither self-starting nor reversible and does not always produce a constant effort on the crank because of the uncertainty of the explosions.

The accompanying drawing shows a new type of external combustion, hot-air engine which has recently been designed by G. Emil Hesse and for which a high thermal efficiency is claimed. Air, heated in an external chamber, is the medium by which heat energy is conveyed to the cylinder, and the cycle of the engine is identical with that of one using steam as a medium. Air is a poor conductor of heat, but it will absorb it and give it off readily if properly split up into thin sheets or layers, and it is this principle which is employed in the Svea caloric engine, as this machine is called. It will be seen from the illustration that there are two cylinders placed one behind the other with two pistons having a common stroke. The forward one is the power cylinder and the rear one is the pumping cylinder for forcing air through the heater at high velocity. Cold air is drawn from the atmosphere into the pumping cylinder and forced into the bottom of the heater at a high velocity. The air coming in contact with the hot plates which are arranged to split it up into thin sheets is rapidly heated and rises through the heater, passing out at the top and into the power cylinder, where it expands down to atmospheric pressure again and is exhausted.



The Svea Caloric Engine.

The drawing is of a 6-h.p. engine which is now being built. It has power cylinders 4¼ in. in diameter and 4⅞-in. stroke, and will run at 450 r.p.m. with 40 lbs. pressure in the heater. The heater is 20 in. in diameter and 16 in. long, and the total weight of the engine and heater is 450 lbs., or but little more than a steam engine of the same power. An Ericsson hot-air engine of only ½-h.p. has a cylinder 10 in. in diameter, makes 75 r.p.m. and weighs 1,700 lbs.

The principal claims made for the Svea engine are that it is self-starting, reversible, double-acting, and is automatically regulated and it can therefore be applied to any kind of work done by the steam engine. Its efficiency is claimed to be nearly double that of the steam engine. The Svea Caloric Engine Company, 119 Nassau street, New York, controls the patents which have been granted on the engine.

# GENERAL NEWS SECTION

## NOTES.

The number of immigrants arriving in New York from Europe is now the greatest on record. In one week 26,000, mostly Italians and Hungarians, were landed at Ellis Island.

A ticket broker at New Orleans has been sentenced to 30 days' imprisonment for contempt of court in violating a preliminary injunction forbidding the buying and selling of non-transferable tickets.

The Pennsylvania has made important reductions in local passenger fares on the Amboy division between Camden and Mount Holly. This action is taken, it is said, for the purpose of meeting the competition of electric lines.

The Pennsylvania Lines West of Pittsburg will build rest houses for the employees at Bradford, Ohio, and at the 59th street yards in Chicago. The buildings will cost, together, $60,000 and are to be placed in charge of the Y. M. C. A. with E. D. Bancroft, of Columbus, as general secretary.

It is reported from Washington that the Panama Railroad has reduced its through passenger fares from $4 to $2.40 (gold) first class, and from $6 to $2.85 (silver) second class. Freight rates have been reduced 50 per cent. and the rate for a telegram of 10 words is reduced from $1 to 25 cents.

The joint office established at the St. Louis Union Station last year for validating World's Fair tickets is to be continued indefinitely. The officers of the roads interested are so well satisfied with the benefits received from the office in the way of detecting fraudulent tickets and prosecuting offences against the state and city laws that they are unanimously in favor of maintaining the office.

On the morning of March 21 there was a landslide on the Middle division of the Pennsylvania Railroad near Millerstown which blocked all four tracks and covered one of them 30 ft. deep for 120 ft. Freight traffic was suspended about 20 hours. A steam shovel was pressed into service to assist in clearing the tracks. The slide occurred at a point where the line of the road was changed last year.

The senate committee which is to investigate the subject of rate regulation during the present recess of Congress will also consider what legislation should be enacted in relation to the liability of railroads for injuries to employees. This addition to the scope of the work of the committee is the result of an amendment offered by Senator Martin, of Virginia, and it appears to have been accepted by Mr. Kean, after some opposition by several senators, to avoid a long contest which would have delayed important appropriation bills.

The railroad commissioner of Ohio has received a complaint against the Lake Erie & Western alleging unlawful rates in violation of Section 3,373 of the Ohio Statutes, and has notified the road to make answer. The state has had a railroad commissioner for many years, but this is the first case in which the commissioner has undertaken to investigate such a complaint as this, the change being due to a recent decision of the Attorney General holding that the commissioner has the necessary authority.

The Sacramento *Union* says that the Southern Pacific has refused the request of the officials of the city and the Sacramento Chamber of Commerce for permission to place Sacramento boomers on overland trains between Reno and Sacramento. The reason given is that "other communities have applied for like privileges and to grant the request of one would mean to allow all." But why not put the boomers on the trains without leave and pay their fares? Or would they be classed with "train-butchers" and be kicked off as nuisances?

The Legislature of Missouri, recently adjourned, had before it a bill to require the use of the block system on all the railroads of the state, modeled in its main features after the bill on the same subject which was introduced in Congress by Mr. Esch, of Wisconsin. The Missouri bill was passed by the Lower House, but it was defeated in the Senate. Mr. Esch's bill, which would have required block signaling on all the passenger roads of the country in the course of nine years, appears to have been buried out of sight by the bills concerning the regulation of freight rates and other matters which proved more absorbing.

The Legislature of Montana, recently adjourned, passed a law limiting passenger fares on the railroads of the state to 3 cents a mile. The law does not apply, of course, to interstate rates. There is a clause in the Act declaring that all persons shall have equal right to purchase mileage books issued by the railroads. The Act does not apply to "independent railroads wholly within the state" until the properly authorized officers of the state shall declare existing rates excessive. The penalty for violation of this law is from $50 to $500 and one-half the fines collected is to go to the party injured. The Act takes effect April 1.

### Bids Wanted for Pennsylvania Tunnels.

Bids are wanted April 18, by Robert H. Groff, Secretary of the Pennsylvania, New York & Long Island Railroad, at 85 Cedar street, New York, for building tunnels in that city from points near First avenue westward under private property and First avenue, Thirty-second and Thirty-third streets, to points between Sixth and Seventh avenues on those streets, as advertised in the *Railroad Gazette*. Proposals and specifications will be furnished on application at the office of the Chief Engineer, 1 West Thirty-fourth street, New York.

### Dust Collecting System at the Angus Shops of the Canadian Pacific.

The accompanying illustration shows part of the elaborate dust collecting system in the planing mill of the Angus shops of the Canadian Pacific. The equipment consists of 17 exhaust fans and six large dust collectors. It serves upwards of 156 wood-working machines. Three of the dust collectors are on the roof of the planing-mill; one is over the cabinet shop and the two others into which they discharge are over the boiler-house.

All of the wood-working machines are hooded so as to insure the maximum suction at the point where chips and shavings are made. This system not only handles the light, dry refuse from the cabinet shops, but it also cares for the shavings from the heavy machines. The stock handled on the heavy machines is largely oak, wet, heavy and stringy, with frequently an inch of ice, which is taken off at the same cut. The fans vary in speed from about 650 to 825 revolutions per minute. The greatest distance through which material is conveyed is about 700 feet.

**Dust Collectors in the Planing Mill of the Angus Shops, Canadian Pacific.**

The efficiency of the system as compared with any method of collecting refuse by hand is two-fold in its character. Not only is the expense of handling greatly reduced but the refuse material is at once rendered available for fuel. The four boilers, which are of about 425 h.p. each, may, by using this system, be fed entirely by shavings, which would otherwise be costly to transport and dispose of. At the boiler house are located additional fans which draw the refuse from the first set of collectors and discharge it to the second set, from which it is delivered

either directly to the boilers or deposited in the shaving house. The shavings, when desired, can also be delivered into cars. When not in use the feed pipes to the boilers may be swung out of position.

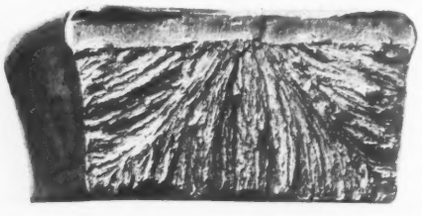
This system was installed by C. H. Clifford & Co., managers of the Philadelphia branch of B. F. Sturtevant & Co.

### One More 2 Ft. Gage.

The Ferrocarril de la Compania Minera de Jimulco has recently been completed in Coahuila, Mexico. This road is 2-ft. gage and operated with a Shay engine, and its average grade is about 7 per cent. It runs from Otto, on the Mexican Central, north to Jimulco, three miles.

### A New Anti-Friction Metal.

The engraving shows a new anti-friction metal, the chief interest of which lies in the peculiarity of its crystallization, which forms the chief basis of claims of superiority made by its producers. The piece shown was nicked on one side and after being placed in a vise, was broken off by a sharp blow from a heavy hammer. A fibrous, stringy mass was revealed, the crystals extending perpendicularly to the chilling surfaces. The alloy is of tin and aluminum base and a remarkable characteristic is that



A New Anti-Friction Metal.

these fibers always radiate from the chilling surfaces, regardless of the number of times reheated, thereby presenting the ends and not the sides of the fiber to the sliding friction surface.

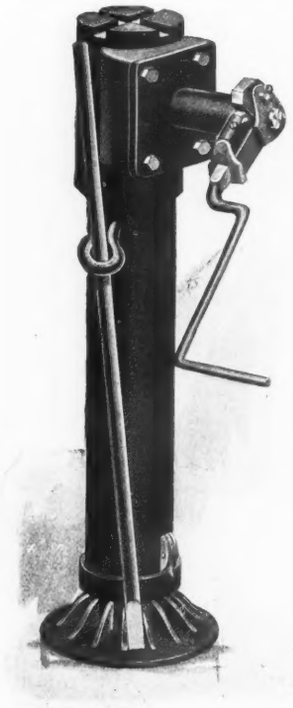
It is well known that in the case of wood and of wrought-iron the surface exposing the ends of the fiber will stand a greater amount of crushing weight and wear than the sides of the material. It was for this same principle in an alloy that the metallurgist who produced this worked, his efforts, it is said, extending over a period of 20 years. The composition has been given many severe tests which were said to be gratifying in all instances. Its great toughness and malleability combined, it is claimed, permits it to withstand the most severe shocks without becoming brittle, or what is ordinarily called "crystallized." A close examination of the fractured metal reveals a fine and smooth texture, with no granular matter intervening, entitling it to be classed as a true chemical compound.

Users of anti-friction metals have experienced difficulty in remelting and using them over, owing to the grosser metals—those which melt at the lowest point—volatilizing and escaping, which leaves the composition harder with each pouring. The producers of this metal say they have entirely overcome this and that by a perfect combination of metals they have secured an alloy which is an entirely new metal and that will admit of remelting an indefinite number of times without becoming hard or harsh or losing any of its original properties. The characteristics of this metal should make it desirable for use in linings of driving box and engine truck brasses, eccentric straps, crosshead gibs, steam and gas engine bearings, ships' bearings and wood-working and all kinds of high-speed machinery.

The Buda Foundry & Manufacturing Company, Chicago, is placing this metal on the market, together with some new bronzes and a copper-steel composition, which is claimed to be a rediscovery of the lost art of copper hardening.

### Two New Buda Jacks.

During the last month the Buda Foundry & Manufacturing Co., Chicago, has added to its list of railroad supplies a line of ball-bearing and cone-bearing jacks, illustrations



Buda Car Jack.

of two of which are shown herewith. The car jack is ball-bearing and well calculated to fill the requirements for which it is intended. It is made in two sizes with capacities of 15 and 25 tons. These are 33 and 34 in. high respectively, have a rise of 20 in., diameter of base, 12 in., and weigh 154 lbs.

Buda Journal Jack.

An advantage claimed for this jack over the ratchet style is that the cars may be left standing on it, obviating the need of blocking.

The journal jack is of 15 tons capacity, 4 in. rise, and weighs 43 lbs. It is cone bearing and is a powerful short-lift jack. It is claimed much time can be saved by its use. The Buda Company has also added several new ratchet and friction jacks to its line.

### London Locomotion.

There is not likely to be any publication of the report of the Royal Commission on London Locomotion before June. Promoters of new tube lines brought forward their proposals again this session for consideration by Parliamentary Committees, these proposals including the "circular" scheme of the Central London Railway, but in the absence of the recommendations of the commission which has been investigating the whole position for several years past, it is hardly likely that the new lines will yet be approved. One of the lines which is considered to be much needed (Hammersmith & North, East London,) has already been shelved and cannot be touched further during the present year.

### The Mersey Electric Railway.

The traffic on this railway, which had such a poor record during its last year or two of steam working, continues to grow under electrification. For the half-year ended December, 1904, the passengers carried numbered 4,657,876 as against 4,153,777 in the corresponding period of 1903 (the early stage of electrical operation), both exclusive of season-tickets. The train mileage was 415,625 miles as compared with 401,046. The total receipts increased from $181,560 to $203,095; and the working expenses, exclusive of the exceptional charges for pumping, ventilation and lifts, were $141,081, or 69.17 per cent., as against $137,071, or 75.5 per cent., in 1903. The exceptional charges mentioned have been brought down from $20,592 (11.34 per cent.) to $18,730 (9.22 per cent.). The number of season-ticket holders—a direction in which special efforts have been made—have increased from 2,036 to 3,120. So far as capital expenditure is concerned this was practically nil during the half year, the actual figure being $10,434 in connection with the electrical installation arbitration proceedings. During the current year some $163,296 has to be expended under electrical works contracts. In the revenue account the traffic expenses showed a good reduction, but there were considerable increases in maintenance of way, works, etc., and in locomotive and generating power. The profits do not admit of dividends, and $40,829 is payable by the British Westinghouse Company toward interest on the debenture stocks. The length of the system is just over four miles, mostly tunnel.

### Isolated National Electric Plant in Chicago.

The National Electric Company, Milwaukee, Wis., has lately completed the installation of a new electric light plant in the Cook County court house, Chicago. The installation is interesting as an example of an isolated plant in the center of a large city, and more so because it replaces a former plant which had become obsolete. The experience with the former plant enabled a better appreciation to be had by the engineers in charge, of the advantage of generating their own current. The use of boilers for heating such a building is an argument in favor of combining an electric light plant with this work, since the additional cost of the attendance required is not great.

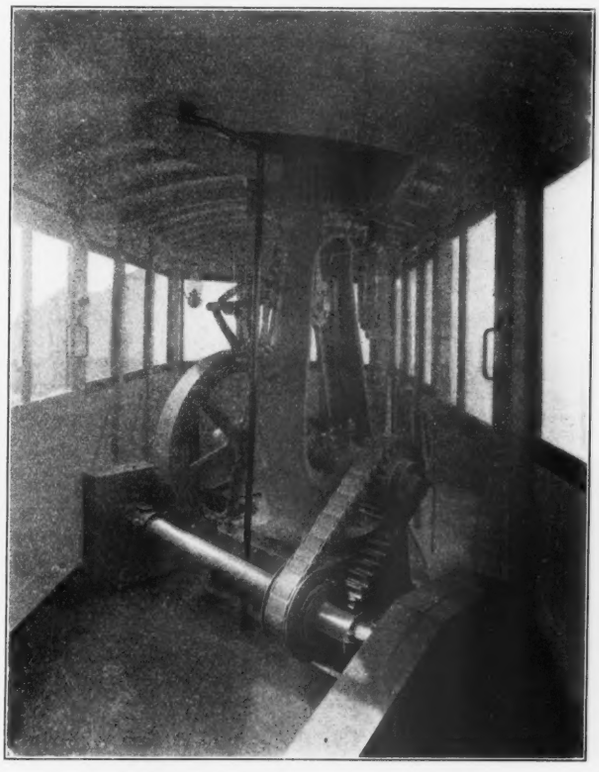
The building is lighted by 16 arc and 2,300 incandescent lamps, requiring 125 volts at the switchboard. The plant consists of a 100-k.w. and one 150-k.w. direct-current engine type, six-pole generators, direct-connected to engines of the four valve, single-cylinder type, the former running at 225 and the latter at 200 r.p.m. The engines are single-cylinder with double slide admission valves and Corliss exhaust valves. The steam pressure is 125 lbs. The new plant is a great improvement on the former belt-driven installation, there being now no appreciable noise or vibration—an important requirement of a plant installed in a public building of this nature. The generators have demonstrated their ability to carry a steady overload of 20 per cent., without sparking, or the necessity of changing the position of the brushes.

### A Novel Yard Sweeper.

The J. G. Brill Company, car and truck builders, have lately delivered the snow sweeper shown in the accompanying photographs to the Pennsylvania Railroad for use at its yards in Philadelphia, and along its Delaware avenue lines where there are grade

Snow Sweeper—Pennsylvania R. R.

crossings. The sweeper is the standard type used in electric practice. It has been adapted to its present service by using a 40-h.p. reversible vertical steam engine instead of a motor. It is drawn by a locomotive which also furnishes the steam to the engine which uses about 90 lbs. of steam, the pressure being reduced by a reducing valve on the locomotive. The crank shaft is connected to another shaft or axle by a chain belt, as shown, and the latter shaft is set at an angle of 45 deg. and has sprocket wheels at either end, which are connected by sprocket chains to the axles of the brooms. The shaft revolves in oil boxes bushed with phosphor bronze and has check plates to take care of the engine motion. The exhaust head and separator have expansion traps for the condensation. All steam pipes under the car are covered with high pressure steam pipe coating. Short brooms are used with the sweeper. These extend from the center of the track to about six inches outside of the rails, and they are placed at an angle of 45 deg. The brakes have ratchet handles and are operated by hand. The length over the end bumpers is 27 ft. 6 in., and over the end sills 21 ft. The width over the outside sills is 6 ft. 10¼ in.; the thickness of the flooring is 1⅛ in.; the size of the side sill is 4¼ ft. x 8¾ ft., and the sill plates are ½ ft. x 8 ft. The sweeper is mounted on Brill gear trucks with double truss rods from each outside pedestal. The wheel base is 6 ft., and the wheels are the 33 in. P. R. R. standard.



Interior of Snow Sweeper, Showing Steam Engine.

### An Echo of the Anthracite Strike.

The Interstate Commerce Commission, in an opinion by Commissioner Clements, has announced its decision in the case of Thompson against the Pennsylvania Railroad. During the anthracite strike of 1902 complainant arranged for the purchase and sale of the surplus product of certain bituminous mines, called surface or country mines, and for hauling the coal by wagon to stations or sidings and loading upon defendant's cars. Under normal conditions this could not be done at a profit. Complainant demanded and received several cars during the month of November, 1902. In that month the road issued a rule limiting its coal cars to mines having track connections with its roads, and this rule was kept in force during the strike period. The demand for coal throughout the strike resulted in the greatest tax upon the railroad equipment and in the congestion of lines, yards and terminals. The mines loading by tipple and by track connection received far less than their usual car supply. The Commission holds that under those and other attendant conditions, defendant's temporary rule confining its comparatively few available cars to mines generally in operation, where quick loading could be accomplished, and declining to permit its sidings or switches to be further congested by loading coal from wagons, not only by complainant, but many others temporarily engaged in the same pursuit, was calculated to hasten rather than retard the movement of coal for public use, and was not unreasonable or unjust. The complaint is therefore dismissed. No opinion, however, is expressed upon the point whether a railroad may, under ordinary conditions, discriminate in furnishing cars as between the methods of loading by tipple and wagon, or whether without a rule it may, even in great emergency, discriminate between the two classes of shipments, and the decision is confined to the particular situation disclosed by the record in this proceeding.

### Congressional Office Building.

Plans are being completed for the new office building for the House of Representatives, and contracts are being let separately for different materials and different parts of the work. The building will be immediately southeast of the Capitol and will front about 476 ft. on B street, 470 ft. on New Jersey avenue, 348 ft. 9 in. on C street, and 452 ft. 6 in. on First street. The design of the building will be classic. It will be three stories high and built around an interior court. It will contain 430 office rooms in addition to kitchens, dining rooms, room for public hearings before committees, etc. In design and exterior finish the building will be subordinated to the Capitol and will correspond with the Senate office building to be built exactly opposite to it on the north side of the Capitol grounds. The contract for stone for the superstructure has been let to B. A. & G. W. Williams, of New York. Work on the foundations will be commenced at once. Contract for the steel work has not yet been let. Mr. Elliott Woods, Superintendent of the Capitol, is in charge of the work.

### Railroad Fire Commissioners.

The Scranton *Tribune* says that the Delaware, Lackawanna & Western, for the purpose of more thoroughly protecting its property from fire, has organized a "Board of Fire Commissioners" for the territory between Binghamton, N. Y., and Washington, N. J. The Commissioners are: Superintendent E. M. Rine, of the Transportation Department; Superintendent R. A. Phillips, of the Coal Department; Superintendent R. F. Kilpatrick, of the Motive Power Department; Superintendent W. B. Hixon, of the Bridge and Building Department, and Superintendent Rudy, of the Water Supply Department.

### Work Undertaken by the Fire Underwriters.

The National Board of Fire Underwriters, composed of 120 of the leading fire insurance companies doing business in the United States, has organized a staff of engineers to investigate conditions and make recommendations for improvements that will minimize the hazard of sweeping fires or conflagrations, especially in the congested districts of the cities visited. This committee has put four parties in the field, composed of experienced engineers who are collecting data and making tests in different cities. The Chief Engineer of the committee is E. G. Hopson, a hydraulic engineer, who was in charge of the department of aqueducts and reservoirs for the commission on additional water supply for New York City, and who designed and laid out in this capacity the entire supply system north of New York City. The National Board points out that the fire waste in the United States greatly exceeds that of other countries, and it believes that with the Baltimore conflagration

as an object lesson it is a good time to start a campaign for safer conditions. The entire work of the committee is under the direct supervision of Herbert Wilmerding, Secretary, 135 William street, New York; and the Federal Government has detailed two engineers of the United States Army to investigate and review the reports of each city, it being the desire of the underwriters that the reports might have final supervision and be criticized by men in no way connected with the business of fire insurance.

### Railroad Shop Tools.

*(Continued.)*

LATHES.

The American engine lathes, made by the American Tool Works Company, Cincinnati, Ohio, are extensively used throughout the leading railroad shops, and the accompanying illustrations show several sizes and types of this make of machine. Fig. 1 shows a 22-in. belt-driven American lathe. The bed is of deep section, and as the beds of all other American lathes, it is of the patented drop "V" type, in which the inner "V" is dropped, by means of which a two-inch additional swing is given to the lathe. The bed is also strengthened by cross-box-girders at short intervals throughout its length. The headstock is bolted to the bed and the cone has 5 steps, the largest being 15 in. in diameter by 3 7/16-in. face. The spindle has a 1 13/16-in. hole through its entire length and it is of high carbon steel. The bearings are of phosphor-bronze and are provided with improved oiling facilities and means for adjustment.

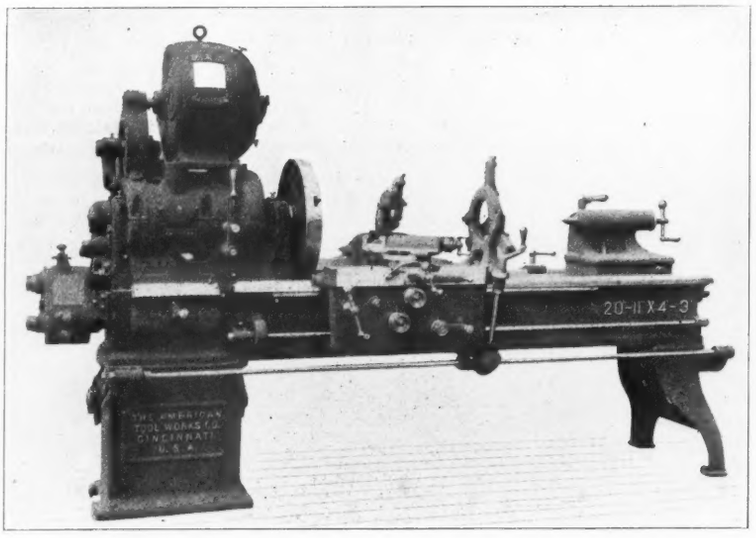


Fig. 2—18-in. American Engine Lathe—Motor Driven Through All-Gear-Head.

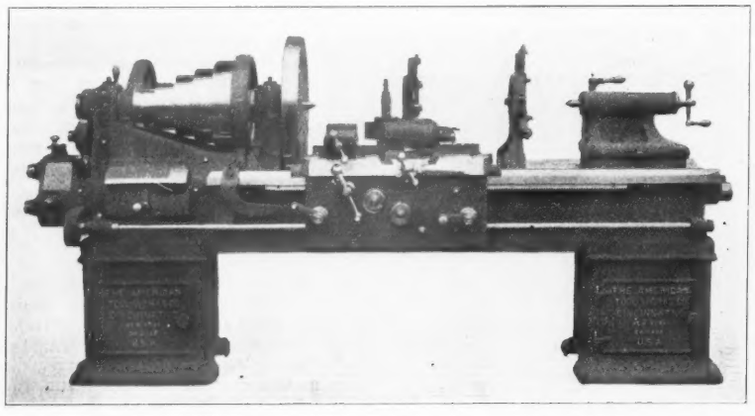


Fig. 1—22-in. American Engine Lathe—Belt Driven.

The tailstock spindle is graduated and the tailstock is fitted with a set-over for turning tapers; it is of the off-set type, which allows the compound-rest to be set in a plane parallel to the bed. The carriage is especially heavy in the bridge, due to the drop-V bed; it has a continuous bearing of 34¼ in. on the ways and it is gibbed to the bed its entire length. The lead-screw is on the inside of the bed and acts directly under the cutting tool obviating any twisting tendency common in lathes having the screw on the outside. The half nuts which engage with the lead-screw are operated by a lever at the front of the carriage. The apron is secured to the carriage by a tongue and groove; the gears are all of coarse pitch and wide face; and both the longitudinal and cross-feeds are reversed from the front of the apron. The compound rest is graduated and the top slide and cross-feed-screws are fitted with micrometer dials. An automatic stop is also provided. It can be set at any desired position and at the proper time it engages with the drop plate, throwing the rack pinion out of mesh and thus stops the motion of the carriage. A double friction countershaft, having pulleys 14 in. in diameter by 4½-in. face, is supplied with this machine. It should run at 135 r.p.m. forward and at 202 r.p.m. backward. The machines shown in the accompanying illustrations are all fitted with a rapid change gear mechanism. In the 22-in. machine just described the change-gear mechanism provides a range of 36 changes for feeding and screw cutting, any one of which can be instantly obtained while the machine is in motion. Thread cutting combinations ranging from 1 to 16 per inch, including an 11½ pipe thread, and feeds varying from 5 to 80 can be obtained with these machines.

The lathes shown in Figs. 2 and 3 are fitted with an all-gear-head. This is especially useful in motor-driven machines, as it makes a simple and compact method of reducing the high speeds of the motor to the customary speeds of the lathe. In the all-gear-head design the headstock is a complete unit. Only six gears are used for the four mechanical speed changes obtainable. The gears are located in the head; they take the place of the cone pulley and are oppositely disposed on the spindle and driving shaft. By means of levers conveniently placed at the front of the head the speed changes can be made while the machine is in motion. The necessary lever adjustment for any desired speed can be determined by referring to an index on the front of the head. The gears, as shown, are protected in a neat and symmetrical box and provision for easy access to the working parts and ample means for lubrication are also provided. When a machine fitted with the all-gear-head is to be belt driven the driving pulley is mounted on the back or driving shaft and the pulley is placed so that the belt can be removed without unlacing. A belt-driven lathe fitted with the all-gear-head may readily be converted into a motor-driven lathe by simply removing the single pulley. Any type of variable speed motor can then be mounted above the headstock, as shown in Fig. 2, and connections to the driving shaft can be made by either spur gearing or silent chain; or, as shown in Fig. 4, the motor can be placed at the rear of the machine and connected to the driving shaft by any desired means, such as a silent chain or belt. The four mechanical speed changes obtainable directly through the all-gear-head can be increased to any desired number by a variable speed motor, if

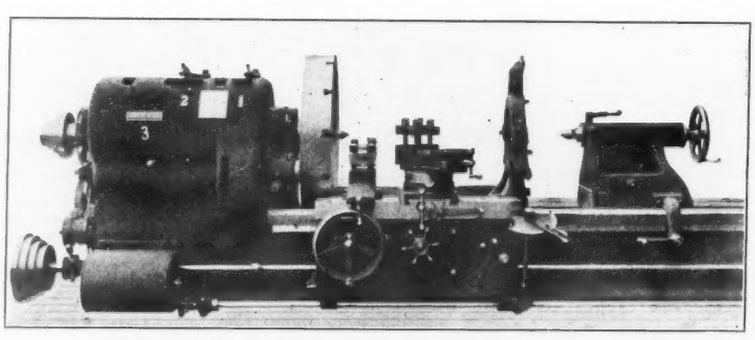


Fig. 3—Side View of 36-in. American Engine Lathe.

motor driven, or by a variable speed countershaft if belt driven.

Fig. 2 shows an 18-in. American engine lathe driven through an all-gear-head by a 5-h.p. motor, mounted above the head and direct connected through gearing to the driving shaft. The controller on this machine is at the back of the leg and is actuated by the crank handle shown at the right side of the carriage. The manipulation of the handle starts, stops, or reverses the machine, and also produces a number of minute variations of speeds obtainable electrically and which supplement the four fundamental speeds obtained mechanically through the all-gear-head. The change-gear mechanism on this machine provides for 44 changes of feed. The range of thread-cutting is from 2 to 32 per inch, including 11½ pipe thread and the speed range is from 8 to 128. The bed is of the drop-V pattern and the lead screw is on the inside of the bed as is the case in all other "American" lathes. The standard length of bed for this machine is 6 ft., but this size of machine is made in even length of bed up to 20 ft. The 6-ft. bed turns 2 ft. 6 in. between centers and swings over Vs 20½ in. and over the carriage 13½ in. The countershaft pulleys are 12 in. in diameter by 4¼ in. face and should run forward at 120 and backward at 180 r.p.m.

Figs. 3 and 4 show the side and end views of the 36-in. triple-geared American engine

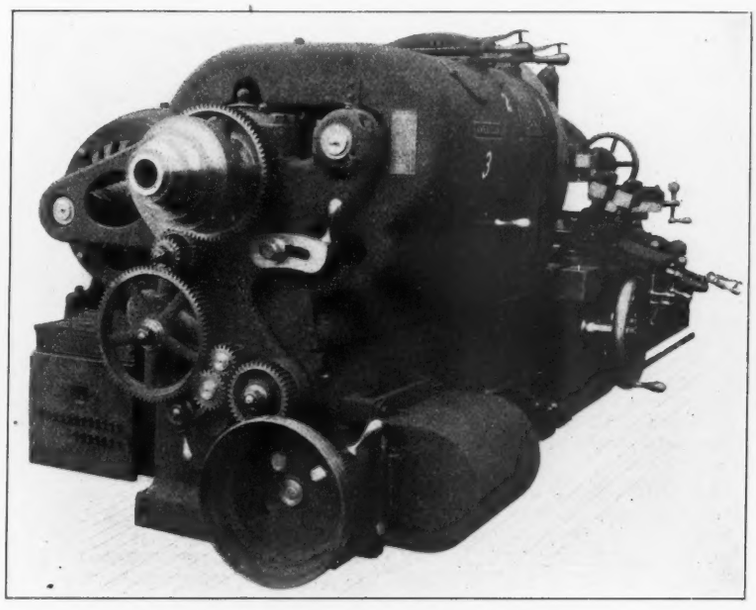


Fig. 4—End View of 36-in. American Engine Lathe.

lathe. Fig. 4 shows the construction of the gear-head and the method of mounting the motor on a base at the rear of the machine. The motor in this case is connected to the main driving shaft by a silent chain drive, as shown. The bed is of the drop-V pattern and rests directly on the foundation. The lathe is made in even lengths from 10 ft. to 30 ft. The 10-ft. machine will turn 4 ft. 7 in. between centers and will swing 36½ in. over the Vs and 28¼ in. over the carriage. The range of thread cutting is from 1 to 16 per inch, including 1½ pipe thread, and the feed range is from 5 to 80. The spindle has a 2 9/16-in. hole through its entire length and the tailstock has a long continuous bearing on the ways and is adjustable along the bed by rack and pinion. The carriage has a continuous bearing of 45 in. on the ways and the compound rest is provided with power, cross and angular feeds for taper-turning and boring.

*(To be continued.)*

### Manufacturing and Business.

According to reports, the municipality of Vienna will soon ask bids for 100 electric motor street cars and 100 trailers estimated to cost $500,000.

The Dodge Coal Storage Co., 49 Dey street, New York, has taken over the business of the United Telpherage Company, of New York.

The Walter A. Zelnicker Supply Co., St. Louis, Mo., has lately bought a large quantity of 50 to 75-lb. steel rails and announces its readiness to furnish them cut to length for building and railroad purposes at a very low price.

The contracts for a double track Page bascule bridge with a single leaf of 150 ft., to be built over the South Fork of the Chicago river, have been awarded to the American Bridge Company for the superstructure, and to Thomas Phee & Company, Chicago, for the substructure. This is to replace a swing bridge used jointly by the Chicago & Alton, the Atchison, Topeka & Santa Fe, and the Illinois Central railroads.

The American Car & Foundry Company has ordered for its Chicago plant a power unit consisting of one horizontal, cross compound Reynolds-Corliss engine, with cylinders 14 and 32 inches in diameter by 36-inch stroke, and one 350 k.w. Bullock engine type generator. Allis-Chalmers Company will supply this machinery, and it has also been awarded the contract for the motors to be used on five new cars now being built by the car company.

The Apex Equipment Co. is in the market for all kinds of second hand cars, rails of all weights and also for three steam shovels of 30, 50 and 60 tons respectively. J. S. Drake, 11 Broadway, New York, is General Manager.

Mr. James M. Coleman, who lately resigned from the position of Master Car Builder of the Central Vermont Railway, is to be Superintendent of the Canada Car Co., Montreal. Mr. Coleman's former associates and subordinates have given him an oak chest containing 159 pieces of solid silver.

The Pittsburg, Cincinnati, Chicago & St. Louis is to build a water pumping plant at Louisville to supply its own water instead of buying from the city, as at present. The cost will be about $30,000. An electric light plant for the yards and station is also contemplated, and the roundhouse will be enlarged.

Bids will soon be asked by the Board of Ways and Communication of Argentina for building bridges over the arroyos San Carlos, Barrancon and Aguanda and the reconstruction of a bridge over the arroyo Clara. The estimated cost is $112,000. Separate bids will be asked for the material and for construction.

Orders for railroad material and supplies are about to be given for several Indian railroad companies. Particulars will be furnished by the Director of Stores, Indian Office, Whitehall, London, S. W.; Secretary East Indian Railway Co., Nicholas Lane, London, E. C.; Bombay, Baroda & Central Indian Railway, Gloucester House, Bishops' Gate street, London, E. C.; South Indian Railway Co., No. 55 Grace Church street, London, E. C.

### Iron and Steel.

The orders booked by the mills for rails to be delivered amount to 1,000,000 tons, and there are orders for about 500,000 tons more.

The Pittsburg Steel Co. has ordered 150,000 tons of steel billets from the Carnegie Steel Co. and 50,000 tons from the Republic Iron & Steel Co. for delivery by July 1.

The directors of the Passaic Steel Co., which has works at Paterson, N. J., have voted to recommend an increase in its capital stock of $1,000,000; also the issue of preferred 7 per cent. accumulative stock, to be offered to the stockholders at par. A vote will be taken by the stockholders at the annual meeting on April 4. The directors have agreed to underwrite the entire issue. After April, Niven McConnell, Vice-President and General Manager, will have charge of the work of building new additions to the plant. Mr. McConnell was formerly General Manager of the Union Steel Works.

## MEETINGS AND ANNOUNCEMENTS.

*(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)*

### Railway Club of Pittsburg.

At the regular meeting of this club March 24 the report of the Committee on Interchange Rules was presented and discussed.

### Engineers' Club of St. Louis.

At the meeting of this club to be held April 5, an address on "The Levee and Drainage Problem of the American Bottoms" will be delivered by Mr. E. G. Helm.

### Franklin Institute.

At a meeting of the Sections held March 30, the program included a paper on "The Design and Manufacture of Alternating Current Generators" by D. B. Rushmore, of the Stanley Electric Manufacturing Co., Pittsfield, Mass.

### Engineers' Club of Philadelphia.

At a meeting of this club to be held April 1, a paper on "Sanitation in Office Buildings" by Henry Leffman; also one on "The Reproduction of Drawings of Great Length and Number," by L. F. Rondinella, illustrated with lantern slides, will be presented.

### Purdue University Trip of Inspection.

The annual trip of inspection of the junior and senior classes of the Schools of Engineering, Purdue University, will take place March 30, 31 and April 1. The party will go to Chicago and spend the three days in inspecting various industrial and railroad establishments. The Victoria Hotel will be the headquarters of the party.

### Western Railway Club.

No. 6, Vol. 17, of the Proceedings for this club containing the report of the reception to the past Presidents which was held on Feb. 21, contains portraits of 20 of these gentlemen, including the present incumbent. The report of the "remarks" made by the speakers is accompanied by letters received by the Secretary from a number of friends of the Association who were unable to be present. The faces shown in the portraits are those of LeGrand Parish, B. K. Verbryck, William A. Scott, J. N. Barr, Charles F. Pierce, G. W. Rhodes, John Hickey, Peter H. Peck, William H. Lewis, William Forsyth, George Gibbs, George L. Potter, A. M. Waitt, F. A. Delano, C. A. Schroyer, Howard G. Hetzler, A. E. Manchester, Professor Goss, F. H. Clark and D. Frank Crawford.

## PERSONAL.

—Mr. D. Driscoll, General Baggage Agent of the Gulf, Colorado & Santa Fe, died recently at the age of 63.

—Col. F. De Funiak, formerly and for many years Chief Engineer of the Louisville & Nashville, died at his home in Louisville on March 29, at the age of 65.

—Mr. A. W. Anderson, General Superintendent of the Atlantic Coast Line, was born near Cartersville, Ga., in 1863, and began

his railroad service at the age of 17. He began as a clerk. In 1885 he was agent and operator on the Port Royal & Western Carolina. In 1893 he was appointed Superintendent, and in 1896, upon the consolidation of that company with the Port Royal & Augusta, he was made General Superintendent, which position he has since held.

—Mr. H. U. Wallace, until recently Chief Engineer of the Illinois Central, is now associated with Thomas Phee & Company, General Contractors, of Chicago.

—Mr. H. H. Gardiner, until recently General Freight and Passenger Agent of the Buffalo & Susquehanna, is now Vice-President of the Bush Terminal Company of New York.

—Mr. D. J. Brumley has been appointed Principal Assistant Engineer of the Illinois Central, in charge of construction. He was formerly with the Louisville & Nashville, but more recently with the Indianapolis Southern, an Illinois Central property, as Division Engineer of Construction.

—Mr. Henry C. Mahanna, formerly and for a number of years Superintendent of the Sioux City & Pacific, died at his home in Fremont, Neb., on March 27, at the age of 61. Mr. Mahanna was a native of Pennsylvania and had been connected with the Chicago & North Western and its controlled lines for many years.

—Mr. Thomas H. Wickes, Vice-President of the Pullman Company, died suddenly in Chicago, on March 28. Mr. Wickes entered the service of the Pullman Company in 1863 as Assistant to the Agent at East St. Louis. In 1885 he was made Western General Superintendent at Chicago. He filled successively the offices of General Superintendent, Second Vice-President, and in 1897 was made Vice-President.

—Mr. O. H. Hobbs, the new Superintendent of the Connellsville Division of the Baltimore & Ohio, was born in Howard County, Md., in 1860. In 1879 he entered the service of the Baltimore & Ohio as a telegraph messenger boy, being promoted successively to telegraph operator in 1880, Train Despatcher of the Cumberland Division in 1883, transferred as Train Despatcher to the Baltimore Division in 1885, to be Chief Train Despatcher in 1892, made Trainmaster of the Cumberland Division in 1897, transferred to the Baltimore Division as Terminal Trainmaster at Washington 1904, and then Trainmaster of the Baltimore Division, from which position he is now promoted to succeed Mr. Irwin.

—Mr. Nathan K. Elliott, formerly General Superintendent of the Terre Haute & Indianapolis, died recently in The Dalles, Ore., at the age of 67. Mr. Elliott began work as a brakeman on the Cincinnati, Wilmington & Zanesville. In 1869 he was appointed passenger conductor on the Terre Haute & Indianapolis, later being promoted to be Master of Transportation. In 1885 he was appointed Superintendent of Transportation, and in 1894 General Superintendent.

—Mr. H. R. Safford, who has been appointed Assistant Chief Engineer of the Illinois Central, is 30 years old. He was born in Madison, Ind., and is a graduate of Purdue University, Class of 1895. His railroad service has been entirely with the Illinois Central. He began as rodman immediately upon leaving college. The next year he became Resident Engineer in charge of construction work, and three years later was appointed Roadmaster. He was made Principal Assistant Engineer two years ago, and in his new position of Assistant Chief Engineer he will have charge of maintenance of way and structures.

—Mr. F. C. Batchelder, who on Saturday, April 1, becomes Superintendent of the Chicago Division of the Baltimore & Ohio, was born on a farm in Wisconsin in 1857, and entered the service of the Chicago, Milwaukee & St. Paul as a telegraph operator in 1874. He was with that company until 1888 filling positions as telegraph operator, agent, train despatcher and Chief Train Despatcher. Then he went to the "Soo Line," and served as Train Despatcher, Chief Train Despatcher, Assistant Superintendent and Division Superintendent successively until 1899, when he resigned and went to the Baltimore & Ohio as Superintendent of the Chicago Division, and has been with the road since as Division Superintendent.

—Mr. J. F. Irwin, who succeeds Mr. Batchelder as Superintendent of the Newark Division of the Baltimore & Ohio, was born near Newark, Ohio, in 1852. He began railroad work on the B. & O., and in 1873 was a telegraph operator on the Lake Erie Division. In 1880 he was transferred to Newark as train despatcher and remained in that position until 1892, when he was made chief train despatcher. In 1897 he was appointed Trainmaster of the Ohio Division, and three years later was transferred to the office of the General Superintendent of Transportation at Baltimore. He was later appointed Trainmaster, and in 1901 was promoted to be Superintendent of the Connellsville Division, from which position he is now transferred to the Superintendency of the Newark Division.

—Mr. Milton Knight, Second Vice-President and Freight Traffic Manager of the Wabash Railroad, died at his home in St. Louis, Mo., on March 27. Mr. Knight was born in Allegheny County, N. Y., in 1836, and had been in railroad service since 1863, his first position being with the Atlantic & Great Western. In 1872 he went to the Cincinnati, Hamilton & Dayton, where he remained until 1878, when he was appointed General Freight Agent of the Wabash, St. Louis & Pacific, and continued in that position with its successor, the Wabash Western. When this latter company was reorganized as the Wabash, Mr. Knight was made Freight Traffic Manager. Later his title was changed to Second Vice-President and Freight Traffic Manager, which position he held at the time of his death. He was a member of the Board of Managers of the Joint Traffic Association.

—Ex-Senator Francis Marion Cockrell, of Missouri, has been appointed Interstate Commerce Commissioner in place of Mr. James D. Yeomans. Mr. Cockrell was born in Johnson County, Mo., in 1834, and is a graduate of Chapel Hill College, class of 1853. He has

been for many years a leading member of the Democratic side of the Senate, serving on the most important committees. His last term as Senator expired on the fourth of this month.

—Mr. William G. Christmas, formerly and for several years Superintendent of the Kanawha & Michigan, died at his home in Charleston, W. Va., on March 16. Mr. Christmas was born in 1871, and began his railroad service on the Virginia Midland, now a part of the Southern. He resigned from the Superintendency of the Kanawha & Michigan a little over a year ago to become Northern Agent for the Kanawha Fuel Company.

—Mr. A. S. Baldwin, the new Chief Engineer of the Illinois Central, was born in Winchester, Va., in 1861. After a special course at private schools in that city, he entered railroad service as a rodman on the Richmond & Allegheny, now a part of the Chesapeake & Ohio. He shortly gave up railroad work to take a position with the Iron & Steel Works Association of Virginia as Engineer, where he remained for three years. In 1883 he returned to railroad service, going to the Baltimore & Ohio as Assistant Engineer on its Philadelphia extension. Three years later he went to the Chicago, Mil-

waukee & St. Paul as Principal Assistant Engineer on its Missouri river bridge at Kansas City; and he went from there, in 1888, to the Louisville & Nashville. He remained with the L. & N. 14 years, being successively Assistant Engineer, Assistant to the Chief Engineer, and Roadmaster. About three years ago he became Principal Assistant Engineer of the Illinois Central, and then Engineer of Construction, the position he now leaves to become Chief Engineer, to succeed Mr. H. U. Wallace.

## ELECTIONS AND APPOINTMENTS.

*Atlantic Coast Line.*—W. N. Royall, hitherto General Superintendent at Wilmington, N. C., has been appointed General Manager, succeeding J. R. Kenly, whose resignation of that office takes effect on April 1. Mr. Royall will report to Mr. Kenly, Fourth Vice-President, who is in charge of the operating department.

A. W. Anderson, hitherto General Superintendent of the Charleston & Western Carolina, has been appointed General Superintendent of the A. C. L., at Wilmington, N. C., succeeding W. N. Royall.

G. G. Lynch, District Superintendent, has resigned. (See Charleston & Western Carolina.)

*Baltimore & Ohio.*—F. C. Batchelder, hitherto Superintendent of the Newark Division, has been appointed Superintendent of the Chicago Division, succeeding J. A. Spielmann, transferred; J. F. Irwin, hitherto Superintendent of the Connellsville Division, has been appointed to succeed Mr. Batchelder at Newark, Ohio; O. H. Hobbs, hitherto Trainmaster, has been appointed Superintendent of the Connellsville Division, succeeding Mr. Irwin, effective April 1.

*Charleston & Western Carolina.*—G. G. Lynch, hitherto District Superintendent of the Atlantic Coast Line, has been appointed General Superintendent of the C. & W. C., succeeding A. W. Anderson.

*Chicago & Eastern Illinois.*—J. C. Muir, hitherto General Superintendent of the Third District of the St. Louis & San Francisco, has been appointed Superintendent of the C. & E. I., succeeding J. F. Russ, resigned.

S. T. Park, hitherto Master Mechanic, has been appointed Acting Superintendent of Motive Power, with headquarters at Danville, succeeding G. W. Smith, resigned.

*Chicago, Milwaukee & St. Paul.*—W. B. Foster, hitherto Trainmaster, has been appointed Superintendent, with headquarters at Des Moines, Ia., succeeding the late F. D. Tucker.

*Chicago, Rock Island & Pacific.*—H. J. Slifer, General Superintendent Central District, having resigned, all matters heretofore referred to him should, until further notice, be addressed to W. M. Hobbs, General Superintendent Transportation.

*Cincinnati, Hamilton & Dayton.*—F. H. Short, Treasurer, has retired from that office after 50 years' service with the company.

J. Boughton, Assistant Auditor of Disbursements, has resigned.

*Eastern Texas.*—E. H. Payne, Treasurer and Auditor, has resigned.

*Great Northern.*—A. G. McGuire has been appointed Assistant General Freight Agent.

*Illinois Central.*—D. J. Brumley has been appointed Principal Assistant Engineer.

*Lake Shore & Michigan Southern.*—The authority of C. F. Daly, Passenger Traffic Manager, has been extended over the Indiana, Illinois & Iowa.

*Lehigh Valley.*—C. A. Austin has been appointed Assistant to Mr. Pindell, Superintendent of Transportation. Mr. Austin's office will be at South Bethlehem.

*Missouri, Kansas & Texas.*—J. O. Whitmarsh, Superintendent, has resigned.

*Mobile & Ohio.*—C. A. Pigford, Superintendent of the Mobile & Bay Shore, in charge of the terminals of that road and the M. & O. at Mobile, will go to Meridian as Superintendent, succeeding Arthur J. Alexander. Mr. Pigford will be succeeded in his present position by S. H. Swetman. Haiden Miller, of St. Louis, General Freight Agent, will also have charge of the work now done under the supervision of J. T. Poe, General Traffic Manager, which office, it is said, will be abolished, but Mr. Poe will remain with the company. James S. Taylor, now General Agent at Mobile, will be promoted to Assistant General Freight Agent, with headquarters in Mobile, while his place will be filled by W. E. England, effective April 1.

*Norfolk & Southern.*—A. H. Flint, President, has resigned.

The position of General Superintendent has been abolished, and the duties have been assumed by the General Manager.

*Ohio State Railroad Commission.*—James C. Morris has been reappointed commissioner.

*Père Marquette.*—J. T. Stafford has been appointed Assistant Master Mechanic, of the Grand Rapids District, with headquarters at Grand Rapids, Mich.

*Rio Grande, Sierre Madre & Pacific.*—H. M. Levinson has been appointed Superintendent, succeeding L. P. Atwood, resigned.

*St. Louis & San Francisco.*—J. C. Muir, General Superintendent of the Third District, has resigned. (See Chicago & Eastern Illinois.)

*Seaboard Air Line.*—J. T. Robinson has been appointed Acting Master Mechanic, with headquarters at Savannah, Ga., succeeding A. J. Poole, transferred.

B. F. Lowther, Master Mechanic, has resigned.

## LOCOMOTIVE BUILDING.

*The Maryland & Pennsylvania* has ordered one locomotive from the Baldwin Works.

*The Ohio River & Columbus* has ordered one locomotive from the Baldwin Works.

*The Central of Georgia* is reported to have ordered five locomotives from the Baldwin Works.

*The National Tube Company* has ordered three small locomotives from the Baldwin Works.

*The Central Railroad of Brazil* is reported to have ordered two locomotives from the Baldwin Works.

*The Canadian Pacific* is reported to have ordered several freight locomotives from the Canada Foundry Co., Ltd., of Toronto, which built 12 locomotives for the same company last year.

*The Pennsylvania Lines West* have ordered 15 E2b Atlantic-type (4-4-2) locomotives, 15 six-wheel switching (0-6-0) locomotives and 15 H6a consolidation (2-8-0) freight locomotives.

*The Baltimore & Ohio* is reported to have ordered the 250 locomotives for which it was said to be in the market in our issue of March 3, from the Schenectady Works of the American Locomotive Co.

*The Chicago, Lake Shore & Eastern* has ordered two switching locomotives from the Baldwin Works. These locomotives will weigh 200,000 lbs. on drivers, with cylinders 22 in. x 28 in. and firebox 96 in. x 72 in.

*The Boston & Albany*, as reported in our issue of March 24, has ordered six simple Pacific-type passenger locomotives and 10 simple consolidation freight locomotives from the American Locomotive Co. The Pacific locomotives are to weigh 141,000 lbs. on drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 75 in. The consolidation locomotives are to weigh 200,000 lbs. on drivers; cylinders, 23 in. x 32 in.; diameter of drivers, 63 in.

## CAR BUILDING.

*The East Shore & Suburban* has ordered a small number of cars from the St. Louis Car Co.

*The Rodger Ballast Car Company* has ordered 50 ballast cars from the American Car & Foundry Co.

*The Cleveland, Cincinnati, Chicago & St. Louis* has ordered 1,500 coal cars from the American Car & Foundry Co.

*The Wabash-Pittsburg Terminal* has ordered 1,000 gondolas and 1,000 hopper cars from the American Car & Foundry Co.

*The Southern* denies the report that it has ordered 1,000 coal cars from Haskell & Barker, as reported in our issue of March 24.

*The Columbia Coal Mining Company*, Philadelphia, Pa., has ordered 700 hopper cars of 100,000 lbs. capacity from the Pressed Steel Car Co., for July delivery.

*The Leeds Forge Company, Ltd.*, of Wortley, England, is reported to have a contract from an Argentine railroad company for 500 steel cars of 80,000 lbs. capacity.

*The Interstate Traction Company*, which is an interurban line recently incorporated in Illinois, has ordered a small number of cars from the St. Louis Car Co.

*The Western Massachusetts*, which is building an electric road at Westfield, Mass., is reported to have ordered eight double-truck cars, four from the Wason Manufacturing Co. and four from the Laconia Car Co., for July 1 delivery.

*The Western Maryland* has ordered 2,000 box cars, 50 flat cars and 50 stock cars from the South Baltimore Steel Car & Foundry Co.; 500 hopper cars from the Cambria Steel Co. and 500 gondolas and 500 box cars from the American Car & Foundry Co.

*The Pennsylvania Lines West*, it is reported, have ordered 41 passenger cars, and will build four combination baggage and passenger cars, 14 baggage cars, eight combination baggage, mail and express cars, two dining cars and nine postal cars at the Columbus shops.

*The Coal & Coke*, as reported in our issue of March 24, has ordered 200 40-ft. drop bottom gondola cars of 80,000 lbs. capacity from the South Baltimore Steel Car & Foundry Co., for June delivery. The special equipment includes: Westinghouse air-brakes, Damascus brasses, Tower couplers and Farlow draft rigging.

*The Duluth, South Shore & Atlantic* has ordered 40 gondola cars of 80,000 lbs. capacity from Barney & Smith, for May delivery. These cars will be 38 ft. long, inside, and 4 ft. 2½ in. high, above floor. The special equipment includes: Congdon brake shoes, Westinghouse air-brakes, Climax couplers, Miner draft rigging, Symington dust guards, journal boxes and lids, Railway Steel Spring Co.'s springs and Diamond trucks.

*The Canadian Pacific* is building 40 cabooses at its Farnham shops instead of 40 baggage cars, as reported in our issue of March 17. These cabooses are to be 29 ft. long and 9 ft. wide, with wooden frames and underframes. The special equipment will include: Axles, 3¾ in. x 7 in.; truck bolsters of wood, body bolsters Canadian Pacific standard plate, Westinghouse air-brakes, Tower couplers, Miner tandem draft rigging, canvas roofs, Goff trucks and cast-iron 33-in. wheels.

*The Boston Elevated*, as reported in our issue of March 24, has ordered 40 semi-convertible vestibule cars from the J. G. Brill Co., 25 for May delivery and 15 for June 10 delivery. These cars are to be 43 ft. 3¼ in. long and 8 ft. 4 in. wide, instead of the dimensions

previously reported, with wooden frames and underframes protected with steel and transite. They are to have a seating capacity of 52 persons. The special equipment includes: Boston Elevated standard axles, brake-shoes, journal boxes and wheels, other special equipment to be furnished by the car builder.

*The Seaboard Air Line*, as reported in our issue of March 17, has ordered 250 hopper-bottom gondolas of 80,000 lbs. capacity (numbered 30,400 to 30,650) from the Huntington works of the American Car & Foundry Co. These cars are to measure 26 ft. 6 in. long and 8 ft. 9½ in. wide, inside measurements, with wooden sides and structural steel underframes. The special equipment includes: Bolsters 5 in. x 9 in.: I-beam truck body bolsters, Seaboard Air Line standard I-beam brake-beams, cast-iron brake-shoes, Westinghouse air-brakes, Tower lock-set couplers with 5-in. shank, Seaboard Air Line standard twin-spring draft rigging, basswood dust guards, Symington journal boxes, Seaboard Air Line standard steel arch-bar trucks and 33-in. cast-iron wheels.

## BRIDGE BUILDING.

ALLENTOWN, PA.—The Council Committee on the Tilghman street bridge reports that the County Commissioners agree to pay $24,000 towards the cost and the Lehigh Valley and the Allentown Terminal Railroad Co., $18,200.

BATTLEFORD, N. W. T.—The Northern Pacific is reported having given the contract to the Canada Foundry Co., of Toronto, for two of the five bridges to be built on the line of its road in the Northwest Territory over the Saskatchewan River. The largest of these will be 2,437 ft. long, including trestle approaches, and it is to have all steel spans each 167 ft. long. The Canadian Bridge Co., of Walkerville, Ont., it is thought will get the contract for the other three bridges.

BOWMANSVILLE, PA.—The Philadelphia & Reading is reported having given a contract to the Pennsylvania Steel Co. for building four large steel bridges in connection with its double track improvements in the line of its road in York and Cumberland counties.

CHARLESTON, S. C.—The Southern Railway is reported making surveys to locate the site for a new steel bridge to be built over the Hiwassee River.

CHICAGO, ILL.—Separate bids are wanted March 31 by F. W. Blocki, Commissioner of Public Works, for building the substructure and superstructure of the North avenue bridge over the north branch of the Chicago river.

CLEVELAND, OHIO.—Bids are wanted April 12 by Julius C. Dorn, Clerk of the Board of Commissioners, for building steel bridges in Newburgh, West Park, Bedford, Solon, Strongville, Palmer and Royalton townships, in Cuyahoga county.

COLUMBUS, N. MEX.—The Colorado, Columbus & Mexican will put up a steel bridge on its proposed line. A. O. Bailey, Columbus, N. Mex., is President.

DAYTON, OHIO.—The City Council, at a recent meeting, granted certain privileges to the People's Railway Co. in consideration of a $20,000 contribution by the railroad towards the cost of a new bridge over the Miami river at Washington street, which insures the building of this structure.

Bids are wanted April 4 by William F. Miller, Clerk of the Board of Public Service, for the abutment walls and the superstructure of the bridge over Wolf Creek at Summit street. Louis Haas is President.

HARRISBURG, PA.—The Pennsylvania and the Philadelphia & Reading, local reports state, are asking bids for building a steel foot bridge 300 ft. long, which will include a covered bridge 75 ft. long, over the Pennsylvania tracks between the two stations.

HAVERHILL, MASS.—Three new bridges will be built over the Merrimac river, one of which, a highway bridge, will be built by the county at a cost of $200,000.

JACKSON, GA.—Bids are wanted April 3 by A. Watkins, Commissioner of Watts County, for putting up a steel bridge 530 ft. long over the creek.

JACKSON, OHIO.—Bids, it is reported, are wanted April 13 by the County Auditor for building the substructures and superstructures of a number of bridges and culverts of concrete in Jackson county. J. W. Turner is County Surveyor.

KENSINGTON, PA.—The Pennsylvania, it is reported, is planning to abolish seven grade crossings between Front street and Frankford Junction; the work to cost about $1,500,000.

LEWISTOWN, PA.—The Pennsylvania will build two four-track bridges over the Juniata river at this place.

NEWCASTLE, IND.—The County Commissioners are asking bids (April 4) for building a steel bridge 100 ft. long in the northern part of the county.

NEWPORT, PA.—The Pennsylvania Railroad Co. will build an iron bridge over the river at this point, replacing a covered structure.

OMAHA, NEB.—The new bridge of the Illinois Central over the Missouri River between this place and Council Bluffs was recently opened for traffic.

PHOENIX, ARIZ.—Two spans of the Phœnix & Eastern Railroad's steel bridge over Salt River at Tempe lately fell into the river, causing a loss of about $50,000.

POINT PLEASANT, N. J.—The bridge over the Delaware river between Raven Rock and this place is to be rebuilt at a cost of about $15,000.

SPRINGFIELD, MASS.—Bids are wanted April 8 by the County Commissioners of Hampden county for the metal work of a highway bridge over the Connecticut river between Chicopee and West Springfield. Robert O. Morris is Clerk.

### Other Structures.

BLOOMINGTON, ILL.—The Cleveland, Cincinnati, Chicago & St. Louis and the Lake Erie & Western, local reports state, will begin work the first of next month on a new union passenger station, to cost about $25,000.

BRUNSWICK, GA.—The Atlantic & Birmingham, it is reported, has secured a site on which it will put up a large freight house, on which work will soon be commenced.

HOMESTEAD, PA.—The Bessemer & Lake Erie Railroad is planning to build car shops during the present year at a point near the works of the Carnegie Steel Co.

JERSEY SHORE, PA.—The New York Central, it is said, will put up a tank and boiler shop, to be 564 x 138 x 50 ft., on which work will be begun at once.

LAREDO, TEX.—The International & Great Northern, it is reported, will put up repair and machine shops to cost $120,000, and is also trying to locate a site for a roundhouse and new car sheds.

MCKINNEY, TEX.—The Houston & Texas Central has plans ready for building a new passenger station.

MIMICO, ONT.—The Grand Trunk will begin work early in April on a new concrete 30-stall roundhouse at this place, and later on will put up a machine shop.

READING, PA.—The Philadelphia & Reading will spend about $500,000 in improvements, including the enlargement of its shops, on which work will soon be begun.

SEATTLE, WASH.—The Northern Pacific, it is reported, will at once build an addition of 100 ft. to its freight house, making the length 1,500 ft.

SHREVEPORT, LA.—The Texas & Pacific, local reports state, will put up a brick freight house to cost about $30,000.

## RAILROAD CONSTRUCTION.

### New Incorporations, Surveys, Etc.

AMARILLO & SOUTHERN.—Surveys are reported under way for this proposed road from Abilene, Tex., on the Texas & Pacific, southeast via Coleman to Brownwood, at a junction of the Gulf, Colorado & Santa Fe and the Fort Worth & Rio Grande, 75 miles.

APPALACHIAN INTERURBAN.—This company has been incorporated by the North Carolina Legislature to build from Hendersonville to Asheville and thence to the South Carolina state line, where connection can be made with the projected line of the Cherokee, Spartanburg & Union. Judge H. Y. Eward and W. A. Smith, of Hendersonville, N. C., are interested in both projects.

(For Cherokee, Spartanburg & Union, see Construction Supplement.)

ASHLAND & TUG RIVER.—This projected road, which is to extend into the Elkhorn coal fields at Big Sandy, Ky., has been given a franchise to enter Ashland, Ky. R. M. Broas is President, and A. M. Kelly, Secretary.

ATCHISON, TOPEKA & SANTA FE.—Press reports state that this company's engineers are making plans for a new entrance into Joliet, Ill., including extensive new yards, in order to have a share in the steel tonnage originating at that point.

It is reported that this company will rebuild seven miles of track and will build a new bridge over the Rio Moro near Watrous, N. Mex. This work is being done for protection from floods, and will involve the removal of the present roadbed from the valley in the canyon to a higher level along the edge of the canyon walls. The new bridge will be 510 ft. long at an elevation of 45 ft. above high water.

BESSEMER & LAKE ERIE.—This company is reported to have let a contract to the C. A. Sims Co., of Philadelphia, for an extension from Gibson Junction, Pa., to Newcastle, 18 miles. The estimated cost is $300,000. Work is to be started at once. There will be a steel bridge over Slippery Rock creek over 200 ft. high. This new line will extend the United States Steel Corporation's railroad to its five large plants at Newcastle.

BOSTON TRANSPORTATION COMPANY.—This company has applied to the Legislature of Massachusetts for the right to build freight tunnels deep under the city of Boston. The plans outlined involve the building of more than 10 miles of tunnels in the business district for the transportation of freight. These tunnels would run to the North and the South stations, the Hoosac tunnel docks, the domestic and foreign steamers and through the principal wholesale sections of the city. By the provisions of the proposed charter, the company must build this 10 miles of tunnels within three years or forfeit $200,000. The cost of the tunnels is estimated at $1,000,000 per mile.

BRONX, YONKERS & WHITE PLAINS (ELECTRIC).—This company has been incorporated in New York State to build an electric railroad from Yonkers east to White Plains, 11 miles. The capital stock is $110,000, and W. H. Whittaker, J. H. Matthews and W. S. Shires, of New York, and F. S. Fisher, E. M. Booth and Nathan Fernbacker, of White Plains, are incorporators.

BUFFALO, ROCHESTER & PITTSBURG.—The General Superintendent of this company is quoted as saying that from $2,500,000 to $3,000,000 will be spent in double-tracking the line near Bradford, Pa., including the elimination of bad grades and curves. Work is to be begun early this spring.

CALGARY & BATTLEFORD.—The Dominion Government has incorporated this company with a capital of $2,000,000 and headquarters at Winnipeg, Man., to build from Calgary, Alberta, to Battleford, Saskatchewan, 300 miles. Power was asked by the company to sell its property to any other railroad, but by the terms of the incorporation it may sell

only to the Canadian Pacific, the Canadian Northern or the Grand Trunk Pacific. (See Calgary, Red Deer & Battleford in Construction Supplement.)

CHARLESTON & SUMMERVILLE (ELECTRIC).—This road, which was recently incorporated in South Carolina to build an electric line from Charleston northwest to Summerville, 24 miles, paralleling the Southern, will, it is reported, be built by the Southern Electric Construction Co., of Gainesville, Ga. Ogden Edwards, of Troy, Ohio, is President, and George Tupper, of Summerville, is Secretary and Treasurer of the railroad company.

CHATTAHOOCHEE VALLEY.—This company has applied for a charter in Georgia to build a railroad from West Point to a point in Carroll County, about 50 miles. E. F. Lanier, J. F. McKemis, N. L. Atkinson and E. J. Collins are among the incorporators.

CHICAGO & MILWAUKEE (ELECTRIC).—The Chief Engineer of this company, which operates 70 miles of electric road connecting 17 suburban towns with Chicago, is quoted as saying that the company's double track line will be extended on private right of way from Waukegan, Ill., north to Milwaukee, Wis., 45 miles, paralleling the Chicago & North-Western and the Chicago, Milwaukee & St. Paul.

CHICAGO, JOLIET & KANSAS CITY.—A company has been incorporated under this name in Illinois, with headquarters at Chicago, to build a railroad from Chicago through Cook, Will, Kendall, Grundy, Bureau, Lasalle, Stark, Henry, Knox, Mercer and Rock Island Counties, via Joliet, to a point on the western boundary of the state. Millard S. Denslow, Elkworth J. Walton, Charles W. Stevens and Joseph Huhn, of Chicago, are directors. (See Chicago, Joliet & Iowa in Construction Supplement.)

COLORADO, COLUMBUS & MEXICAN.—An officer writes that this company, incorporated in New Mexico, plans to build a road from Columbus, N. Mex., via Deming, Gallup and Durango to Salt Lake City, Utah, 700 miles; and to let contracts soon for grading, track laying and bridge work. The work is not difficult. The maximum grade is to be 1 per cent. and the maximum curvature 4 degrees. There will be one steel bridge. A. O. Bailey, Columbus, N. Mex., is President.

COLUMBUS NORTHERN.—This company has applied for a charter in Georgia to build a line from Columbus to West Point, 30 miles, or to Lagrange, 40 miles. Press reports say that this may be the projected extension of the Georgia, Florida & Alabama north of Columbus. Charles L. Davis, of Warm Springs, Ga., and O. C. Bullock, T. W. Bates and E. P. Owlsley, of Columbus, are among the incorporators.

CONWAY, COAST & WESTERN.—An officer writes that, in addition to the information published in our Construction Supplement, location surveys from Conway, S. C., to Marion, 34 miles, have been completed. In addition to the section from Conway to Cool Springs, 11 miles, which is under construction, bids will be received April 1 for the remaining 23 miles to Marion. F. A. Burroughs is President, and R. E. Beaty, Chief Engineer, both of Conway, S. C.

CORNING, KEUKA LAKE & ONTARIO.—This company has awarded the contract for building 35 miles of line from Savona, N. Y., on the Erie, north through Sonora, Bradford and Wayne to Penn Yan, on the New York Central, 35 miles, to Arthur Kennedy, of Pittsburg. Charles S. Haynes, of Hamilton, Ont., will be the engineer in charge. (See Construction Supplement.)

DELAWARE & EASTERN.—This company, which was incorporated in New York State in November to build a railroad from East Branch, N. Y., on the New York, Ontario & Western, along the west bank of the Delaware River, through the towns of Harwick, Colchester, Shavertown, Union Grove and Margaretsville to Arkville, on the Delaware & Ulster, 45 miles, has made application to the State Railroad Commission for permission to build its projected line. The company will have $600,000 capital, and permission to issue $1,100,000 of bonds is being asked for by the promoters. The new line will run through a farming district which is now remote from railroads. H. A. V. Post, Russell Murray and G. A. Lee, of New York City; L. A. Watres and C. D. Simpson, of Scranton, Pa., and Edward Kelly, of Wharton, N. J., are interested. (See Construction Supplement.)

DULUTH, MISSABE & NORTHERN.—Press reports say that this company will double track all the portions of its main line between Duluth and Mesaba Junction which are not now double tracked, a total of about 30 miles. Grading is reported already under way.

Surveys are reported being made for a line from the western terminus of this road at Hibbing, Minn., to the Mississippi River, 25 miles.

DURANT & LEXINGTON (ELECTRIC).—This company has been granted a charter in Mississippi to build from Durant via Castilian Springs to Lexington, 12 miles. It is reported that contracts have been let and that construction will begin in April. Chester Jones is Secretary, and Truman Jones and W. O. Glines are interested.

EAST WATERFORD & KANSAS VALLEY.—This road, it is reported, is to be built from East Waterford, Pa., to Sulphur Springs and into the Kansas Valley. This is projected to reach the timber properties of Hockenberry & Breck, recently purchased from the Perry Lumber Co.

ERIE.—The contract for double-tracking nine miles of the main line between Mansfield, Ohio, and Ashland, is reported let to Kidder & McCourt, of Akron, Ohio. Work is to be begun at once. Part of the 17-mile stretch between Mansfield and Ashland is already double-tracked.

FINDLEY LAKE & STATE LINE (ELECTRIC). This company has been incorporated with a capital of $130,000 in New York State to build an electric railroad 13 miles long in Chautauqua County. F. R. Nichols, Titusville, Pa.; E. A. Austin, Cutting, N. Y., and F. E. Mulkie and G. A. Elston, Corry, Pa., are incorporators.

GRAND RAPIDS & KALAMAZOO VALLEY (ELECTRIC).—This company is reported to have let the contract for building its projected electric line from Kalamazoo, Mich., to Grand Rapids, 60 miles, to the Westinghouse Electric & Manufacturing Co., of Pittsburg. The contract price is said to be between $1,200,000 and $1,500,000. The road will probably be finished within a year.

GREAT NORTHERN.—This company is said to have recentlly let contracts for 200 miles of new line in North Dakota. This includes: A branch from Williston, near the western boundary of the State, north 40 miles.

The extension of the Hope branch from Aneta north about 40 miles to a connection with the main line.

A 15-mile extension of the Lakota branch from its present terminus at Munich, beyond Edmore, Ramsey County.

A 40-mile branch from the main line to York, Benson County.

This company is reported to have let a contract to A. Guthrie & Son, of St. Paul, for part of a second line from its ore docks at Allouez, on Lake Superior, to its terminus at Ellis, 100 miles. The contract covers a new line from Wingate, formerly called Wrenshall, west to the Wisconsin-Minnesota state line, five miles.

GREENVILLE & KNOXVILLE.—This company has been authorized in South Carolina to amend its charter and change its name to the Greenville, Greenwood & Knoxville. Its projected road is to run from Greenville, S. C., to Greenwood, 50 miles. H. H. Prince, of Greenville, S. C., is interested.

HAMILTON, ANCASTER & BRANTFORD (ELECTRIC.)—This company is reported to have let the contract for grading its projected road to W. O. Johnston & Bros., of Iowa. Work is already under way.

HOUSTON & PORT ARTHUR SHORT LINE.—This road is projected from Port Arthur, Tex., west to Houston, 80 miles. A franchise is reported to have been granted at a special meeting of the City Council of Port Arthur, which provides that work must be begun within 60 days and the road completed within two years. Contracts are reported let for 20 miles of grading.

HUNTINGTON, COLUMBIA CITY & NORTHWESTERN (ELECTRIC).—Subsidies amounting to $82,500 are reported to have been voted to this company, which proposes to build an electric road from Huntington, Ind., north to Goshen, 50 miles, where it is to connect with the Indiana Railway Company's line to South Bend.

INDIANAPOLIS & CHICAGO AIR LINE (ELECTRIC).—This company has been incorporated in Illinois with a capital stock of $100,000 to build an interurban electric line from Indianapolis through Jolietville, Kirklin, Michigantown, Flora, Rickfield, Francesville, Crown Point and Indiana Harbor to Chicago. Work, it is reported, is to be begun at once. J. W. Aldeman, William S. Taylor, Charles J. Raub and George R. King, of Indianapolis, Ind., are incorporators.

JALISCO & MICHOACAN (ELECTRIC).—It is reported that work will be begun in October on this projected electric line from Guadalajara, state of Jalisco, southeast, paralleling the Mexican Central, to Lake Chapala, 40 miles, and eventually into the state of Michoacan. By the terms of the concession, the entire line must be completed within three years. William Backus, of Cleveland, Ohio, is Vice-President, and J. M. Zermeno is Manager.

JOHNSON CITY, BAKERSVILLE & SOUTHERN.—An officer writes that this company, recently incorporated in Tennessee to build a railroad from Johnson City south through Unicoi County to the North Carolina state line, has work under way by its own forces and 8½ miles of track laid. The maximum grade is to be 0.5 per cent. with few curves. William E. Uptegrove, of New York, is President, and J. B. Thomas, General Manager.

LANSING MANUFACTURERS' RAILROAD.—The contract for building this belt line six miles long around the city of Lansing, Mich., connecting the Grand Trunk, Michigan Central and the Lake Shore, has been let to W. E. Tench & Co., of 273 Park street, Detroit, Mich. Work is to be begun at once. (See Construction Supplement.)

LINVILLE RIVER RAILROAD.—It is reported that this company, which is to build a lumber road from Cranberry, N. C., into timber lands, is advertising for laborers to begin construction work. The William Ritter Lumber Co. is interested

LONG ISLAND.—On March 21, the Brooklyn Grade Crossing Commission approved the final plans for the removal of the tracks of the Long Island from grade on the entire line of the road from Bay Ridge and from Manhattan Beach to Atlantic avenue at East New York, and northerly to the boundary line between Kings and Queens Counties at Cooper avenue, about 10 miles. These plans were prepared jointly by the engineer of the commission and the engineer of the Long Island Railroad. The estimated cost of the work is $5,955,342, of which $5,677,875 is for doing away with grade crossings and $327,966 for streets not yet opened. The expense is to be borne half by the city and half by the railroad. (See Construction Supplement.)

LOUISVILLE & NASHVILLE.—This company is reported to have let a contract for the reconstruction of its line between Guthrie, Ky., and Greenbriar, Tenn., on the St. Louis, Evansville & Nashville division, 25 miles, to J. E. Rhodes & Co. and E. H. Wilson, both of Knoxville, Tenn. This work will include new bridges over Red River and Sulphur Fork.

This company is reported to have let a contract to J. E. Rhodes & Co. for building a branch from a point in Campbell County, Tenn., between Lafollette and Jellico, up Crooked Fork, five miles.

MEXICAN ROADS.—A concession has been granted to Dwight Furness to build a standard-gage electric road from Guanajuato, state of Guanajuato, south to Irapuato, 25 miles. Surveys are reported to be now under way, and Mr. Furness is quoted as saying that construction work will be begun this summer, and that the line will be eventually extended to Salamanca, on the National of Mexico.

A company is reported to have been formed to build a railroad from Tepic, territory of Tepic, west to the port of San Blas on the Pacific Ocean, 30 miles. The sum of $800,000 is reported to have been given as a bonus for the enterprise, and rights of way for the entire distance. Leon Balch is interested.

Messrs. Ryan & Dudley, of Chihuahua, Mex., are reported to have the contract for building the line of the Calera Mining Co. from San Isidro, state of Chihuahua, to Cerro de la Calera, in the Guerrere mining district. (See Construction Supplement.)

A railroad 50 miles long is projected which is to extend from the San Antonio plantation near Ocatitlan, state of Vera Cruz, to a connection with the Vera Cruz & Pacific. R. K. Williams, of Seattle, Wash., is reported to be in charge of the surveys.

Work is reported under way on a railroad which is being built from Oaxaca southeast to a point on the isthmus of Tehuantepec, 100 miles. Grading is reported finished to Tula. The road is being built by Wenceslao Garcia, who holds the concession, and Archbishop Eulogio Guillow, of Oaxaca, with their private means.

Work is reported nearly finished on a railroad which is being built from San Dieguito, state of San Luis Potosi, on the Mexican Central, south to Tancanhuitz, 20 miles. Dennis J. Spillane is in charge.

The government of the state of Chihuahua has granted a concession to a company from the United States to build from Baca, on the main line of the Mexican Central, to Sierra de Almolya. Under the terms of the concession, construction work must be begun within six months and the road completed within three years.

Work is soon to be begun on a railroad from Sandias, state of Durango, on the Mexican International, to Sierra Candela, which is in a large lumber district. The firm of Balsiger Schuter Suers., of Durango, is interested.

A narrow-gage railroad is being built from Zitacuaro, state of Mexico, to San Jose Malacatepec, 16 miles. Grading is reported completed for four miles. William McLachlan is the contractor.

The Jalisco Exploitation Co. is reported incorporated at Guadalajara, Mex., to build a standard-gage electric road from Guadalajara southwest to the port of Chamela, on the Pacific ocean, 150 miles. The first building is to be from Guadalajara to the Soledad ranch, 24 miles, where water power can be obtained for an electric power plant. M. C. Miller is President, and C. H. Wittemore, of Mexico City, General Manager.

The Guerrero Mining & Exploration Co. is reported to be considering the building of a tramway from the Los Grados mines to its mill, six miles. Ferd. McGann, of Guerrero, is Manager.

The Mexican Flume & Lumber Co. is building a railroad from Quirio, state of Michoacan, on the National of Mexico, southeast 12½ miles into the timber belt surrounding Las Cruces, where the company's mills are situated. Part of the grading and bridge work has been finished. By the terms of the concession under which the road is being built, it is reported that the railroad company is allowed to charge rates 25 per cent. in excess of the rates charged by other railroads in Mexico in consideration of its carrying freight of the republic of Mexico at half rates and officials of the Mexican Government free. The company's New York address is 66 Broadway. (See Construction Supplement.)

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—This company is reported to have awarded contracts for building its projected extension from Thief River Falls, Minn., west to Warren, and thence in a straight line to Kenmare, N. Dak., passing through Marshall County, Minn., 45 miles, and through Walsh, Cavalier, Rolette, Bottineau and Ward Counties, N. Dak., 250 miles. Contracts are reported let to Winston Bros. Co., of Minneapolis, and Barnard & Gorder, of Crookston, Minn. (See Construction Supplement.)

The contract for an extension of the Frederic branch from Frederic, Wis., northeast to Sauntry on the Chicago, St. Paul, Minneapolis & Omaha, 65 miles, is reported let to Edmond Bros. The completion of this line would bring the Minneapolis, St. Paul & Sault Ste. Marie to within 32 miles of Superior and 36 miles of Duluth.

MISSISSIPPI CENTRAL.—This company is reported to have let the contract for grading its extension from Silver Creek, Miss., west to Brookhaven, 28 miles, to the Worthington Construction Co., of Birmingham, Ala. (See Construction Supplement.)

MISSOURI, KANSAS & TEXAS.—This company, it is reported, will build a new line over the proposed route of the Trinity, Cameron & Western from Granger, Williamson County, Tex., on its South Texas line, east via Cameron, Hearne and Madisonville to Trinity, Trinity County, 125 miles. At Trinity the proposed line would connect with the company's isolated line from Trinity east through Groveton to Colmesneil, Tyler County.

MISSOURI, OKLAHOMA & GULF.—This company is reported to have let contracts to J. W. Hoffman & Co., of Kansas City, for grading and to the Wisconsin Bridge & Iron Co. for bridge building on its projected line, which is to run eventually from Joplin, Mo., via Wagoner, Correta, Muskogee, Henryetta, Dustin and Coalgate, Ind. T., to Denison, Tex., with a branch from Henryetta to Shawnee, Okla. T., 57 miles. Surveys for the entire line are finished and grading is reported completed from Muskogee south to the north fork of the Canadian River, 55 miles. The line from Muskogee to Correta, 10 miles, has already been finished. (See Construction Supplement.)

NEW LONDON & EAST LYME (ELECTRIC).—This company, which is planning to build an electric line connecting the Connecticut towns named in the title, is reported to have let a $40,000 contract for equipment to the Westinghouse Electric Co. The National Construction Co. is the contractor for the construction work.

NEW ORLEANS GREAT NORTHERN.—This company is reported to have let the contract for building 340 miles of line from New Orleans north along the Mississippi, and between that and the Pearl river, to W. J. Oliver, of Knoxville, Tenn. Seventy-five miles of the road are to be completed in four months. (See Construction Supplement.)

NEW PARK & FAWN GROVE.—An officer writes that this company, which was recently incorporated in Pennsylvania to build an extension of the Stewartstown Railroad from Stewartstown east via New Park to Fawn Grove, nine miles, will probably let contracts for construction on or before May 1. The road is to run along an elevated plateau between Deer Creek, Md., and Muddy Creek, Pa. Very little grading will have to be done, and there will be no important bridges. There is to be one short grade of 2 per cent. but no sharp curves. The road will be operated by the Stewartstown Railroad. J. H. Anderson is President and J. C. Wiley, of New Park, Pa., Vice-President and Treasurer. S. M. Manifold, of York, Pa., is Chief Engineer.

NEW YORK, NEW HAVEN & HARTFORD.—The four tracking of the Shore Line division for a distance of four miles on both sides of the new double-track bridge which is to be built over the Connecticut River at Saybrook, Conn., is reported to have been authorized by the directors.

OKLAHOMA & TEXAS.—This company is reported chartered with a capital of $5,000,000 to build from Oklahoma City southwest to a connection in Texas with the Fort Worth & Denver City, 200 miles.

OMAHA, LINCOLN & BEATRICE (ELECTRIC). This company, which proposes to build an electric road from Lincoln, Neb., northeast to Omaha, 55 miles, is reported to have let the contract to William C. Ross, of the Ross Construction Co., for building the line, which, according to the terms of the contract, is to be completed by January 1, 1904. Grading is reported already completed from Lincoln to Bethany, 5 miles.

PAN-AMERICAN RAILROAD.—This company is reported to have work under way on a line from a point in the state of Oaxaca, Mexico, on the National Tehuantepec, east to the boundary of Guatemala.

PENNSYLVANIA.—This company is reported to have let a contract to the Kerbaugh Construction Co. for building two additional tracks on the Northern Central from the north end of the present four-track system at New Cumberland to the new Enola yard at West Fairview, 7 miles. This will include a stone arch over the highway and the line of the Valley Traction Co. at Bridgeport, opposite Harrisburg.

The new low-grade line of this company from Safe Harbor, Lancaster County, on the old Columbia & Port Deposit, east to Frazer, Chester County, on the main line, 30 miles, is to be pushed to completion. Work is under way by the Smith Construction Co., which has recently greatly increased the number of men at work. (See Construction Supplement.)

It is reported that work will shortly be resumed on the cut-off at Newport, 35 miles west of Harrisburg, beginning at a point about two miles east of the city and reaching the main line at a point about two miles west. Most of the work was done last year. A new stone arch over the creek and a new bridge over the Juniata River must be built. The old line will be maintained to reach industrial plants. The contract is reported to have been let.

PENNSYLVANIA LINES WEST.—It is reported that the directors have decided to spend $12,000,000 for improvements during 1905. The principal work will be the building of the Enon cut-off, which will run in a very direct line from Enon, Pa., on the Pittsburg, Fort Wayne & Chicago, east to Redbank, on the Allegheny River, on the Philadelphia & Erie, 50 miles. This line will run about 45 miles north of Pittsburg.

PENNSYLVANIA ROADS.—It is reported that a narrow-gage road is to be built from Indian Creek, Fayette County, Pa., to a point near Connellsville, and that the contract for building the line has been let by the Mountain Water Supply Co., to J. H. Swan.

Press reports state that the Kennerly Coal & Coke Co., of Somerset, Pa., will receive bids in April for building 10 miles of railroad.

PENSACOLA, COLUMBUS & WESTERN.—This company is reported incorporated in Tennessee, Alabama and Florida with W. S. Keyser, President, and J. E. Stillman, Treasurer.

PHILADELPHIA & READING.—This company is reported to have let the following contracts: For four-tracking 3½ miles of the present line from Glen Lake, Pa., to Janney, along the New York Short Line cut-off, to the John Shields Construction Co., of New York.

For building four miles of third track to be used for east-bound freight from Skillman, N. J., north to Bellemead, four miles, to the B. M. & J. F. Shanley Co., of Philadelphia.

For four-tracking the main line between Linfield, Pa., and Aramingo, 1½ miles, to the Hoffman Engineering & Contracting Co.

For building of a third track for southbound traffic from Royersford, Pa., one-half mile east of Aramingo, to Mingo, 1½ miles, to Willauer & Son, of Pottstown, Pa.

For building an additional track from Douglassville to Monocacy, two miles, to the John Shields Construction Co.

Double-tracking of the East Pennsylvania between Reading and Allentown, 3½ miles, to John McMinemy.

This company is reported to have decided to double track its Philadelphia, Harrisburg & Pittsburg branch from Harrisburg southwest to Shippensburg, 41 miles. This will require an expenditure of about $600,000. Some contracts have been let.

SEABOARD AIR LINE.—This company is reported to have awarded contracts to the W. B. Bradley Construction Co., of Richmond, Va., for improvements in Portsmouth and Abbeville, Ga.

SEABOARD TRACTION.—This company has applied to the City Council of Portsmouth, Va., for the right of way for an electric railroad to run from Smithfield, Va., through Portsmouth, Suffolk and Petersburg to Manchester, opposite Richmond, Va. Work is to be begun within six months and the line to be completed within two years. L. R. Britt, of Norfolk, is President, and W. H. Robinson, General Manager.

SPOKANE & INLAND (ELECTRIC).—This company is reported to have awarded the contract for grading 22 miles of its line from Spokane, Wash., south to Rock creek to Porter Bros., of Spokane. The road is projected to run further south into the Palouse region in Whitman County, near the Idaho line.

STEWARTSTOWN RAILROAD.—(See New Park & Fawn Grove above.)

STROUDSBURG & NORTHAMPTON (ELECTRIC).—This company, which proposes to build a trolley line from Stroudsburg, Pa., south to Bethlehem, 30 miles, and eventually to Easton and Philadelphia, has applied for a franchise at Stroudsburg. Charles H. Latta, of Bethlehem, Pa., is General Manager.

SYLVANIA & BURTON'S FERRY.—This company will apply for a charter in Georgia in order to build a railroad from Sylvania north via Mill Haven to Burton's Ferry, 18 miles.

TEXAS ROADS.—Two railroads are projected to Rio Grande City, Tex.; one, the Laredo & Rio Grande, from Laredo south 100 miles, and the other, the San Antonio & Rio Grande City, from San Antonio south 225 miles.

VIRGINIA & KENTUCKY.—It is reported that this company, whose road runs from Wise, Va., to Gladeville Junction, four miles, plans to extend its line along Birchfield Creek and Crane's Nest River up Long's Fork, through Stanley and Yates Gap and down Holly Creek to Clintwood, Va., 21 miles. Subscriptions amounting to $25,000 are reported to have been raised at Clintwood in aid of this extension, and it is expected that the survey will shortly be begun. F. M. McClure is Superintendent at Wise, Va.

WASHINGTON, ALEXANDRIA & MOUNT VERNON (ELECTRIC).—This company is reported to have begun work on double-tracking its line from Washington to Alexandria, 7.7 miles. (See Railroad Corporation News.)

WATERTOWN RAILROAD.—It is reported that bids will shortly be received for building this road from Watertown, S. Dak., west to Lake Kampeska, 10 miles. A. L. Rowe is Secretary of the Watertown Transportation Co.

WESTERN PACIFIC.—An officer writes that this company has absorbed the Butte & Plumas and the Indian Valley railroads, chartered to build in Butte and Plumas counties, Cal., from Oroville via the North Fork canyon of the Feather river to a point near Quincy, 45 miles. Surveys made during the past two years have shown that the Western Pacific's line can be built from the Sacramento Valley through the Sierras to the plains of Nevada with a maximum grade of 1 per cent. and a maximum curve of 10 degrees. On the route surveyed, the Sierras are to be crossed at an elevation of 5,000 ft. at the top of a 120-mile grade, the first 40 miles a less than ½ per cent. grade, and the remaining 80 miles a 1 per cent. grade. Press reports state that the Western Pacific has also bought control of the Boca & Loyalton, which runs from Boca, Cal., on the Southern Pacific, through Loyalton to Beckwith, 40 miles. Contracts for construction are reported to have been let to Kilpatrick Bros. & Collins, of Lincoln, Neb.; the Utah Construction Co., of Ogden; MacArthur Bros., of Chicago, and another Chicago firm.

WEST FORK & VALLEY RIVER (ELECTRIC).—This company has been chartered in West Virginia, with a capital of $100,000, to build an electric road from Clarksburg paralleling the Baltimore & Ohio to Grafton, 22 miles. Gordon B. Late and C. H. Warner, of Bridgeport, and R. G. Altizer and Phillip Steptoe, of Clarksburg, are incorporators.

WEST VIRGINIA, PITTSBURG & ATLANTIC.—It is reported that this company has been incorporated to build from Rowlesburg, W. Va., to Durbin, 100 miles. C. W. Mosser and C. E. Mower, Hendricks, W. Va.; E. D. Baker, Beverly, W. Va.; H. A. Armstrong, Parsons, W. Va., and R. F. Whitner, Philadelphia, are incorporators.

## RAILROAD CORPORATION NEWS.

ATCHISON, TOPEKA & SANTA FE.—The statement of this company for the month of February shows a decrease in gross earnings of $677,554 and an increase in operating expenses of $152,982, giving a decrease in net earnings of $830,536. For the eight months ended February 28, gross earnings decreased from $46,566,459 in 1904 to $44,692,134 in 1905, a decrease of $1,874,324. Operating expenses in 1905 were $29,436,173, against $28,203,381 in 1904, an increase of $1,232,793. This gives net earnings of $15,255,961 in 1905, against $18,363,078 in 1904, a decrease of $3,107,117. The average operated mileage for the period is 8,301.82, an increase of 179.90 from 8,121.89 in 1904.

BUFFALO, BRADFORD & KANE.—The control of this company, whose road extends from Bradford, Pa., southeast to Smethport, Pa., 26 miles, has changed hands, and the new president is W. W. Bell. The Kinzua & Big Level Railroad, which runs from Ormsby, on the B., B. & K., westward to a connection with the Baltimore & Ohio near Mt. Jewett (10 miles), has also been bought by the same interest, and the B., B. & K. runs through over this line to Kane, using 12 miles of the Baltimore & Ohio under lease. The K. & B. L. has $50,000 of bonds outstanding, which have been purchased. The two roads are to be consolidated. The capital of the Buffalo, Bradford & Kane is $300,000, with no mortgages or debts of any kind. S. S. Bullis is First Vice-President; G. P. Bullis, Second Vice-President, and R. S. Bullis, Secretary and Treasurer. The general offices are at Bradford, Pa.

CANADIAN PACIFIC.—The New York Stock Exchange has listed $16,900,000 additional ordinary capital stock, to be issued from time to time after April 3 on notice of issue and payment in full. This makes the total issue of ordinary capital stock $101,400,000.

CENTRAL OF GEORGIA.—The statement of this company for the month of February shows a decrease in operating ratio from 86.22 per cent. in 1904 to 84.34 per cent. in 1905, with a decrease of $4,226 in net earnings. For the eight months ended February 28 gross earnings were $6,936,501, against $6,564,668 in 1904, an increase of $371,833. Expenses and taxes were $5,034,982 in 1905, an increase of $54,970. This leaves an increase in net earnings of $316,863, from $1,584,656 in 1904 to $1,901,519 in 1905. The operating ratio for the eight-month period has decreased from 75.86 per cent. to 72.59 per cent.

COLUMBUS & NINTH AVENUE (ELECTRIC).—N. W. Harris & Co., New York, are offering $100,000 first-mortgage 5 per cent. gold bonds of this New York City street railroad company, principal and interest guaranteed by the Metropolitan Street Railway Co. The total issue, including these bonds, is $3,000,000. The Columbus & Ninth Avenue was consolidated with the Metropolitan in 1895, and its entire capital stock, amounting to $3,000,000, was exchanged share for share for stock of the Metropolitan.

CONNECTICUT RAILWAY & LIGHTING.—This company's report for the six months ended December 31 shows a total gross income of $1,116,236, gross operating expenses of $715,176, and net earnings of $401,059. Of these amounts, the income from railroad properties was $773,662; operating expenses for same $484,287, and net earnings $289,377.

CONSOLIDATED RAILWAY (N. Y., N. H. & H.).—The directors of the Springfield Street Railway are to call a meeting of the stockholders and issue a circular letter without recommendation, announcing the offer of the New York, New Haven & Hartford to buy the stock of the Springfield Co. for $225 a share.

DELAWARE & HUDSON.—The annual report of this company for 1904 shows gross earnings of $34,655,113 and expenses and taxes of $27,202,634, giving net earnings of $7,452,479. Subtracting interest and rentals of $2,999,957, this gives a net income of $4,452,522, which is at the rate of 11.06 per cent. on the capital stock counting the capital as $35,000,000 until March 31, 1904, and $42,000,000 thereafter. This was an increase of $537,728 over 1903. During the year the company built or bought the following new equipment: Fifty locomotives, 20 passenger cars, three mail cars, one baggage car, two combination cars, 100 flat cars, 50 coal cars, six milk cars, and 15 company cars.

KANSAS CITY SOUTHERN.—A circular has been issued to the stockholders of this road by Hermann Sielcken, chairman; Daniel G. Boissevain and Alexander D. Kleinwort, of Kleinwort, Sons & Co., London, representing a majority of the capital stock, asking for proxies looking to a new management for the road. Holders of voting stock certificates for preferred and common stock are asked to forward their certificates endorsed in blank not later than April 7 to the chairman of this committee, to be exchanged for stock certificates. This announcement is taken as conclusive evidence that the Dutch interests will control the road.

LAKE ERIE & WESTERN (NEW YORK CENTRAL).—The annual report of this company for the year 1904 shows gross earnings of $4,999,010, a decrease of $220,718 from 1903. Expenses were $3,720,090, against $3,831,321 in 1903. This gives net earnings of $1,277,920, a decrease of $109,487 from 1903.

LOUISVILLE & NASHVILLE.—At the special meeting of the stockholders of this company on March 29, a mortgage of $50,000,000 was authorized on the property of the Atlanta, Knoxville & Cincinnati division. About $9,000,000 of this amount will be reserved to retire underlying bonds.

MEMPHIS STREET RAILWAY.—The purchase of this company, which operates about 80 miles of electric road, is announced to have been made by Ford, Bacon & Davis and Isador Newman & Son for $2,500,000. The present stock is to be replaced by $2,500,000 5 per cent. preferred and $2,500,000 common. The bonded indebtedness of $5,000,000 has been assumed by the purchaser. It is reported that the new management will build extensions.

MIDLAND RAILWAY OF NOVA SCOTIA.—It is reported that this road, which runs from Windsor, Nova Scotia, on the Dominion Atlantic, to Truro, on the Intercolonial, 58 miles, has been purchased by the Dominion Atlantic, and is to be extended to Tatamagouche, on the Straits of Northumberland, with a branch to Brule.

NEW YORK CENTRAL & HUDSON RIVER.—On April 19 the stockholders will vote on approving a plan for the consolidation of the Beach Creek Extension Railroad, the Curwinsville & Bower, the Pittsburg & Eastern and the Clearfield & Southern into a corporation to be known as the Beach

Creek Extension Railroad, which is to be leased to the New York Central for 999 years from June 1, 1905.

The report for this company's entire system for the quarter ending March 31, 1905, shows earnings from operation, partly estimated for 1905, of $18,450,000, compared with $17,231,453 in 1904, an increase of $1,218,500; expenses of operation $13,767,100, against $13,102,055 in 1904, an increase of $665,000. This leaves net earnings of $4,682,900, against $4,129,398 in 1904, an increase of $553,500. There has been a decrease in surplus over income of $230,400 and an increase in fixed charges and taxes of $312,100, which leaves the net income for the year $768,300, a decrease of $11,000. The balance available for dividends is $693,300 (.44 per cent.), against $1,653,100 (1.25 per cent.) paid in dividends. This leaves a deficit of $959,800 for the quarter, against $970,828 last year.

New York City Interborough.—This company, affiliated with the Interborough Co., which operates the subway and elevated railroads in Manhattan, has been organized to operate lines in the Borough of the Bronx, New York City. It has received the permission of the New York State Board of Railroad Commissioners to issue $5,000,000 of capital stock and $5,000,000 of bonds, and to use the overhead electric trolley.

New York State Barge Canal.—State Comptroller Kelsey will advertise on April 3 for the sale of $2,000,000 3 per cent. canal improvement bonds. Bids will be received until noon April 20.

New York, Westchester & Boston (Electric).—Representatives of the New York & Port Chester are petitioning the Attorney General of New York State to have the charter of the New York, Westchester & Boston declared invalid. In behalf of the application, it is asserted that the charter of the company lapsed in 1882 and that the special act of the legislature passed in 1903 does not restore it. It is also said that the company was never really incorporated, as its certificate filed with the Secretary of State did not have attached, as required by law, a declaration that 10 per cent. of the capital was paid in.

Niagara Transfer.—The certificate of public necessity granted this company some time ago by the New York State Railroad Commission for the construction of its proposed line from Buffalo to Tonawanda has been cancelled by the Appellate Division Court at Albany. The application was opposed by the New York Central on the ground that the new road was not required, and that the New York Central was willing to build spurs into any part of the territory to be served by the new company. An appeal may be taken to the Court of Appeals.

North American Company.—This company, which has a large ownership in electric railroads, will increase its capital stock from $17,000,000 to $30,000,000. This step was recommended by the directors on account of the purchase of traction properties in St. Louis, Mo.

Ottawa River.—This company's name, by permission of the Canadian Railway Commission has been changed to the Central Trunk Railway.

Pennsylvania.—At a meeting of the directors on March 29, an issue of $100,000,000 3½ per cent. 10-year convertible bonds was authorized. These bonds are convertible into stock at 150 and are redeemable at par after five years upon 90 days' notice, the conversion privilege to continue until the bonds have been actually paid. The bonds will be offered at par to the stockholders. Arrangements have been made for the underwriting of this issue by J. P. Morgan & Co. and Kuhn, Loeb & Co. jointly, the two firms taking all bonds not subscribed for by the stockholders. The proceeds from the sale will be used to take up $27,000,000 6 per cent. consolidated mortgage bonds maturing next June. It will also provide means for subscribing to an increased issue of Pennsylvania Co.'s stock, the proceeds of which will be used to pay off the latter company's $50,000,000 notes maturing next October.

Pontiac, Oxford & Northern.—This company, whose road runs from Pontiac, Mich., north to Caseville, on Saginaw Bay, 100 miles, has been placed in the hands of Robert J. Lounsbury, of Pontiac, as receiver. Suit was begun by the minority stockholders in June, 1903, alleging mismanagement by the party in control.

St. Louis & San Francisco.—A suit is now in progress in the Supreme Court of Illinois begun by holders of Chicago & Eastern Illinois trust certificates, with Elihu Root as counsel, to abrogate an agreement made between the St. Louis & San Francisco and the Chicago & Eastern Illinois by which it is claimed that the Chicago & Eastern Illinois has been involved in a traffic agreement which would greatly lessen the value of its securities if, by violation of the conditions of the sale of the Chicago & Eastern Illinois to the St. Louis & San Francisco, the C. & E. I. should be taken over by the Colonial Trust Co. of New York, trustee, and operated independently. The traffic agreement is said to be that the Chicago & Eastern Illinois, in return for the promise of the Memphis & Southeastern, a 'Frisco property, to turn over all its freight in Chicago to the C. & E. I., was to guarantee a semi-annual net revenue to the Memphis & Southeastern of not less than $485,000. The holders of the Chicago & Eastern Illinois certificates assert that the 'Frisco dealt with itself in the matter and caused an annual fixed charge of $970,000 to stand ahead of any dividend on the Chicago & Eastern Illinois preferred and common stock. By the conditions of the sale of the Chicago & Eastern Illinois to the 'Frisco at $250 a share in 1902, the 'Frisco guarantees 10 per cent. on the trust certificates representing the stock deposited with the trustee.

St. Louis, Brownsville & Mexico.—This company has registered $1,059,000 of bonds in Texas, which have been issued on the 141 miles of road completed and in operation from Brownsville, at the southern extremity of Texas, north to Robstown, 151 miles.

St. Louis, Cabool & Little Rock.—This company has filed at Salem, Mo., a mortgage to the Trust Co. of America, of New York, to secure an issue of $10,000,000 first-mortgage bonds covering its projected main line from St. Louis south to Little Rock, Ark., with a branch from Springfield, Mo., to Gainesville, a total of 436 miles.

Union Pacific.—The amount of Union Pacific convertible bonds outstanding on March 28 was $46,240,000. The stock outstanding was $149,929,900.

Wabash.—A committee has been formed representing holders of from $5,000,000 to $7,000,000 of the $26,500,000 debenture "B" bonds to try to bring about a change in the policy of the company, by which interest will be paid on these bonds or some adjustment made. These bond holders claim that the earnings have been and are being unnecessarily and unjustly diverted from interest payments to improvements. No interest has ever been paid on the debenture "B" bonds. The company's counsel has suggested a plan for a new issue of $60,000,000 50-year gold bonds secured by a mortgage on the entire system, including the Chicago-Detroit, Buffalo, Des Moines and Omaha divisions, which are not covered by the present debenture issue, and future additions acquired. Of this $60,000, $3,500,000 bearing 4 per cent. interest and preferred as to both principal and interest, would be issued in exchange for the present debenture "A" bonds. The remaining $56,500,000 would bear 2 per cent. interest annually for two years, 3 per cent. for three years and 4 per cent. thereafter. Of this amount, $26,500,000 would be exchanged at par for the existing "B" bonds. The balance of $30,000,000 would be set aside to be used as required for improvements. The committee has not approved this plan, and, although in favor of a settlement without litigation, has made a formal demand on the Mercantile Trust Co., trustee, for an account of the earnings of the property. A statement has been made by a member of the committee to the effect that as the earnings of the road were sufficient to cover the 6 per cent. annually due to the debenture "B" bond holders, he should oppose any exchange by which the debenture "B" bonds would be rated at less than 110. The committee, which consists of Henry Evans, President of the Continental Insurance Co.; Henry K. Pomroy, of the banking firm of Pomroy Bros., and President of the New York Stock Exchange, and George M. Cumming, Vice-President of the United States Mortgage & Trust Co., have called upon other holders of these bonds to subscribe to a defence fund to the extent of 1 per cent. of the par value of their holdings.

Washington, Alexandria & Mount Vernon (Electric).—This company, whose road runs from Washington, D. C., to Rossiyn, 5.6 miles, connecting Washington with the Arlington National Cemetery, and from Washington to Mount Vernon, 15.8 miles, and which carries both passengers and freight, has been reorganized and, it is reported, has passed into the control of the Pennsylvania. The former bonded debt has been cancelled and a new first mortgage to the Real Estate Trust Co. of Philadelphia as trustee has been made to secure $2,500,000 5 per cent. gold bonds of 1955 subject to call at 110 and interest on any interest date on three months' notice. Of these new bonds, $1,500,000 has been sold to Graham & Co., of Philadelphia, and $1,000,000 has been reserved to be issued on account of new acquisitions, betterments, etc., on the basis of 80 per cent. of the actual cost. The capital stock of the reorganized company is $1,500,000. The new station and offices in Washington, adjacent to the Post Office at Twelfth street and Pennsylvania avenue, are almost ready for occupation. A new double-track line is to be built which will run over the new highway bridge being built by the District of Columbia over the Potomac river between Washington and Virginia. The line over the Long Bridge used in common with the steam trains can then be abandoned. Additional equipment is reported to have been ordered, to be delivered in April and May. Clarence P. King is President, Henry H. Pearson, Jr., is Vice-President, and Frank K. Hipple, Secretary. (See Construction columns.)

Washington Terminal.—The capitalization of this company, which is building the new union station of the Pennsylvania and other roads at Washington, is $5,000,000 authorized capital stock (par $50), of which $2,500,000 has been issued. A mortgage has been made to the United States Trust Co., of New York, as trustee to secure an issue of $12,000,000 bonds. The first block of $10,000,000 of these bonds will bear interest at the rate of 3½ per cent. and the remaining $2,000,000 at a rate not exceeding 4 per cent. The bonds will mature February 1, 1945, without option of earlier redemption. A. J. Cassatt is President and C. W. Woolford, Secretary.

West Chester, Kennett & Wilmington (Electric).—The foreclosure sale of this road, which operates about 16 miles of track between Avondale and Kennett, Pa., and Wilmington, Del., is advertised for April 20 at Kennett. The minimum acceptable bid will be $110,000.

Western Maryland.—Blair & Co. have recently offered, at a price to net about 4¾ per cent., $500,000 first-mortgage 4 per cent. gold bonds of 1952. These bonds make a total of $29,367,000 outstanding of the authorized issue of $50,000,000.